JOURNAL

OF THE

AMERICAN WATER WORKS ASSOCIATION

VOL. 30 DECEMBER, 1938 No. 12

CONTENTS

Watering the Grass Roots. By P. B. Niles 1917
Public Relations from Standpoint of a Municipally Owned Plant. By Howard E. Wolbert 1923
The Viewpoint of the Water Commissioner. By Joseph J. Plank 1926
Operating a Small Water Works Plant. By L. E. McQueen 1929
The Arlington County Water System. By A. T. Lundberg 1938
Fire Protection Elements of Water Works. By Sanford Herberg 1946
Fire Protection and the Distribution System. By George Tatnall 1953
Main Cleaning in New Rochelle. By Eugene T. Cranch. 1964
An Unusual Standpipe Failure. By Charles H. Bliven. 1971
New Emergency Repair Truck for Minneapolis. By J. Arthur Jensen 1974
New Uniform System of Accounts. By A. L. Adams .. 1978
Research—An Essential Tool. By L. W. Wallace 1986
Discussion by A. A. Potter 1991
Filter Materials, Filter Runs and Water Quality. By H. E. Hudson, Jr. 1992
Developments in Water Bacteriology. By R. F. Goudey. 2010
Water Filtration Practices in Canada. By G. Hudson Strickland 2030
Mathematics of Water Treatment. By R. Hulbert 2052
Hydraulics and Water Works Engineering. By H. N. Lendall 2063
Specifications and Testing of Deep Well Turbine Pumps. By James C. Harding 2071
New Publications 2081
Abstracts 2083
Coming Meetings v
Additions to Membership List vi
News of the Field 1

All correspondence relating to the publication of papers **should be addressed to**

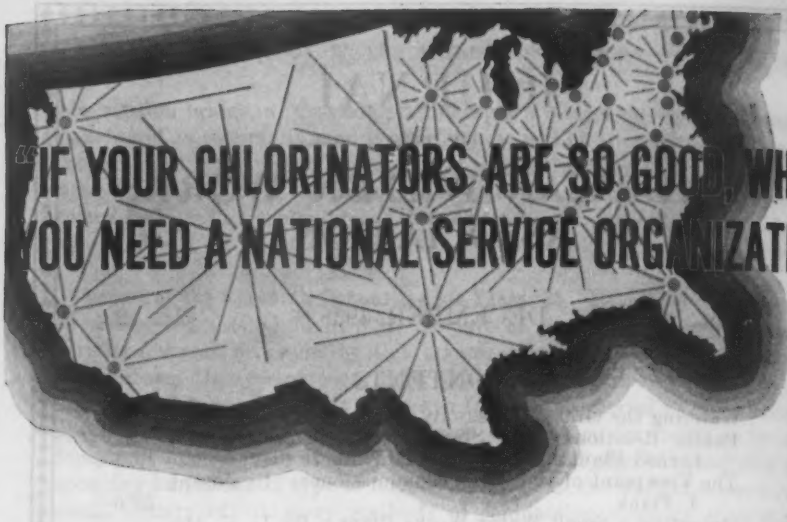
Harry E. Jordan, Secretary

22 East 40th St., New York

$7.00 of Members dues are applied as subscription to the Journal

Additional single copies, to members—50 cents

Single copies to non-members—75 cents



THAT'S a fair question, Mister, and one that we're glad to answer. The whole story is embodied in one word—RESPONSIBILITY.

W&T Visible Vacuum Chlorinators are good chlorinators. They are designed by competent engineers, thoroughly experienced in the correct application of chlorination under all sorts of conditions. They are built by standardized manufacturing methods from the finest materials available. They are tested before leaving the W&T factory under the conditions which will accompany their installation in the field. They are installed under the supervision of trained W&T engineers and the operators are thoroughly instructed in the care and operation of the equipment before the W&T men leave.

BUT—if W&T responsibility stopped there, the job would be only half done, for any piece of mechanical apparatus, no matter how carefully designed or how finely built, is subject to occasional outage for repair or adjustment. And in this outage, danger lies—danger to the health of the people over whom chlorination stands guard. So, in the beginning of their business, the founders of W&T decided that the sale of chlorinators must be reinforced by SERVICE—an organization of capable, trained men, strategically located throughout the country, whose services would be readily available to every chlorinator installation no matter where it was located. That is what W&T SERVICE means. Not just routine supply of spare parts and mechanical help from a few central points, but a nationwide staff of technically trained experts whose responsibility is the continued satisfactory operation of every W&T Chlorinator and whose services are available within a few hours in time of emergency or pressing need. And in times of disaster the voluntary services of this organization have been of great value to supervising health authorities and operating officials.

That, Mister, is the "Why" of W&T service—an ideal of RESPONSIBILITY upon which has been built the world's largest chlorinator business, a twenty-five year record of complete dependability in advancement and protection of the public health.

"The Only Safe Water is a Sterilized Water"

WALLACE & TIERNAN COMPANY, Inc.

Manufacturers of Chlorine and Ammonia Control Apparatus

NEWARK, NEW JERSEY
Branches in Principal Cities

CHLORINATORS FOR WATER WORKS • SEWAGE PLANTS • SWIMMING POOLS • INDUSTRIAL PLANTS

JOURNAL

OF THE

AMERICAN WATER WORKS ASSOCIATION

COPYRIGHT, 1938, BY THE AMERICAN WATER WORKS ASSOCIATION

Reproduction of the contents, either as a whole or in part, is forbidden, unless specific permission has been obtained from the Editor of this JOURNAL. The Association is not responsible, as a body, for the facts and opinions advanced in any of the papers or discussions published in its proceedings.

Vol. 30 December, 1938 No. 12

WATERING THE GRASS ROOTS

Public Relations

BY P. B. NILES

I am told, although I have never been there, that there is a lawn fronting Chatsworth, the noble ancestral castle of the Duke of Devonshire in England, which is a thing of beauty and a joy to the beholder. I am told that this sod is over two hundred years old; that it is rich and luxuriant.

Now a lawn of this kind didn't just happen. It reveals the tender care of a host of careful gardeners stretching down through the generations, most of them Scotch, I presume. The grass roots have been enriched with fertilizer and when the usual abundant rainfall of the British Isles failed, that grass has been watered with such regularity that its roots would continue to grow strong and luxuriant. This lawn has been brought to its present perfection by regular and persistent solicitude on the part of the owners of that lovely estate.

I want to draw an analogy between that lawn and the most serious problem that confronts business today—the job of getting along with people. By people, I mean customers that buy from business, the

---

A paper presented at the New York Section meeting, Poughkeepsie, N. Y., September 22, 1938, by P. B. Niles, Adv. Mgr., American Water Works and Electric Co., Inc., New York, N. Y.

employees that live through the jobs which are furnished by business and the investors who have lent their money so that business might exist and grow.

My assignment is "Public Relations from a Standpoint of Privately Owned Companies," but I submit that whether a water company or any other utility be privately or publicly owned, it faces the same problem of getting along with people, and they are the same people. The only difference to my mind is that in the case of publicly-owned utilities, you can substitute the word "taxpayer" for the word "investor." In the case of the publicly-owned utility property, the taxpayer who is the owner, receives no actual dividend, but he can, in the case of a well managed and efficient property, secure savings in the cost of his utility service or in the general taxes which he pays.

I had best stick to my assignment as I have never worked for any but a privately-owned water company, although as a customer and taxpayer I have had experience with government ownership and operation. The views which I express are those of the Company which I am proud to serve, and do not necessarily represent the thoughts or policies of any other part of the privately-owned water works industry.

Getting back to those grass roots, it seems to us that a favorable public relations setup cannot be produced over night. The friendship of a community must be cultivated as those Scotch gardeners cultivated that beautiful lawn—not in any mood of currying favor but from the standpoint of good will and a desire to carry out the job in hand.

I am going to assume that there can be no public friendship for a company whose service is bad, or whose rates are unreasonable, or whose management is harsh and arrogant. I am going to take it for granted, and I know that you will agree with me, that the basis of good public relations is, first: good service at reasonable rates.

Now it is true that a company may have good service and its charges may be fair, and yet it may be afflicted with the distrust and suspicion of its customers. How can such a company change this condition so that it will receive smiles instead of scowls? This is the essence of the problem. I think it begins with the staff of the company itself. If the employees are satisfied with their treatment, if they understand the principles and policies that actuate the company, and if they respect and admire their superiors, that company is well advanced on the road to winning the friendship of its customers.

After all, the public largely judges a water company and most other businesses by the people who represent it. From the manager down, every employee is either a walking "good-will agent" or a public detractor from the reputation of the company. I do not think there is any such thing in this respect as a happy medium—a utility employee is a boost or he is a knock for his company.

Number one job, therefore, seems to be the development of personnel policies designed to make the organization a cohesive, cooperative and efficient group working for the best interest of the company and its customers. I do not want to go too far into this phase, but I should like to suggest that such matters as working conditions, group and accident insurance, safety work, recreational facilities and last but most important, the attitude of the supervisory staff to the rank and file employees are points that could well be explored by water company managements desirous of strengthening the morale and friendship-making power of the operating personnel.

The next step in cultivating the grass roots of public friendship is a thorough analysis of the company's attitude to its customers. I mean "the face" that the company turns to the public. If that face is cold, severe, harsh, pompous or servile, there probably is not going to be much chance of cultivating many grass roots. We feel that the public expects and demands from its water utility friendly, prompt, courteous and efficient service. This applies to all points of contact. For instance, in our offices, we try to provide quick and efficient service to a customer who has business with us. In recent years we have remodeled most of our offices to improve their appearance and to facilitate the helping of the customer. We have tried to eliminate such things as long waits at windows and have provided information desks where the wants of the customer can be quickly analyzed and dispatched.

Besides matters of physical appearance and business efficiency, we select and train our people who meet the public in the front office to carry on their work courteously and quickly. You may not think it, but it takes a particular type of personality to wait on, day in day out, large numbers of the public and do this in such a way as to make friends and leave a good taste in the customer's mouth. You may feel that such a person is almost a paragon of virtues, but such is not the case. By experimentation and careful selection it is possible to put behind the desks in the front office the right kind of a personality to meet the customer.

I say desks, advisedly, because we long ago eliminated grills and

other brass work from our offices because this hardware tended to give a feeling of frozen formality to our places of business. I remember many years ago that a customer of a water company remarked to me that the reason the company had the grill work in the office was to protect its employees from being punched in the nose by the indignant public. We do not look for any punches these days for we do not believe we deserve them, but if they are coming, our employees are right out there in the open with their chins up.

Another very important matter with regard to office routine is the availability of the manager of the water company. All our managers are readily accessible to our customers who know that if they have a serious complaint or some question that is disturbing them, it is possible for them to go immediately to the top of the organization. Our office employees are encouraged to pass on the difficult type of customer, and there is such, to the man in charge.

We train our outside employees in much the same manner as the people in the office. Meter readers, who are smartly uniformed, go about their jobs with a smile and a friendly "how do you do." Sometimes they do more than read meters, although we can't encourage this because meter readers' time goes into the cost of the service, yet there have been occasions when our meter man have walked a dog, fixed a screen or listened for a leak. Similarly with truck drivers, collectors, "on and off" men—they all know and want to do their particular job in such a manner as to earn the respect and friendship of our customers.

Pumping stations, purification plants and reservoirs are also important from a public relation standpoint. Where our plants are accessible and their natural location is such as to attract the people, we make them into public parks and provide a place of beauty and comfort for the public. Such locations are appreciated by our customers and well used. Our plant employees are always ready to show the public through our stations and explain the various processes followed in furnishing a public water supply. So much for the face we turn to the public. With the cooperation of the working personnel and the proper training and selection of individuals for the particular jobs, much can be done to win and keep customer friendship.

Other matters come up in the course of operation which might be classified as irritants. These are considerably more difficult to solve, yet a sincere and careful effort must be made to eliminate these difficulties, otherwise no firm public friendship can be attained. Matters affecting service such as pressure conditions in regions that

have grown rapidly, tastes and odors in the water, excessive hardness—these must receive the study of management to see whether there is a practicable and economical solution. In questions of this kind full and adequate publicity is extremely important. It has been our experience that the public is fair when it understands the entire problem, and it will bear with management if they are convinced that some point about their water service with which they are not entirely satisfied, cannot be eliminated within the realm of reasonable economy.

Good management is largely a question of being alert, and in building good public relations we must be always ready to show our customers the interest which we have in the community and our desire to serve them well and faithfully. Sometimes little things can contribute largely to the end in view. We have an activity during the summer time in the more than eighty plants under the management of our company, of which we are proud. This is our summer play shower activity which is carried on by these companies in the congested areas where live many under-privileged children. In time, probably the construction of more swimming pools and better playground facilities will eliminate this program, but we estimated last summer that more than 100,000 children were each week enjoying the spray showers on play streets under adequate supervision either furnished by ourselves, the city administration or sometimes the WPA.

I know that this activity has gained our companies many friends. Its cost is relatively low from the point of view of personnel employed, and as you can well realize, the water so used does not constitute a considerable item. We designed our own play shower for this activity and furnish it to our operating subsidiaries.

We are now exploring the possibilities, in more northerly regions, of furnishing outdoor skating rinks for the public during the winter time, with the particular thought in mind of keeping the children off unsafe rivers and ponds.

There are so many facets to the jewel of good public relations that I am afraid I could fill many more pages. I have tried to sketch some of the high points. Every locality is different from another and must be studied in respect to its own peculiarities. No slide-rule formula can be handed down for winning customer good will except those general policies which I have described above. In this respect too "there is no royal road to wisdom."

As you know, business is much agitated about the question of public relations. There are many individuals or concerns that

purport to be able to solve your public relations problems over night. We know this can't be done. I am not in any way criticizing the many reputable public relations counsels and advertising agencies who can bring to questions of this kind, considerable experience and good judgment. I do want to make the point that in building public friendship the check book is no substitute for personal effort. Good advice, yes, but hiring some one else to carry on activity that company management should perform, will draw from the public Priscilla's oft-quoted question, "Why don't you speak for yourself, John?" The public is pretty quick to sense the presence of outsiders. Business in this country has always had a tendency to build up its procedure and over-functionalize various activities. This can be done in public relations work and it is usually unnecessary. Perhaps business can be accused in years past, of having followed a policy of "dollar diplomacy" in some of these activities. The concern that wishes to operate with friendship and at peace with its customers, will be well advised to remember the adage that there is no fertilizer for the fields to compare with the footsteps of the farmer.

Without wishing to seem too much of a Pollyanna, I feel that business and public utilities, in particular, have come a long way in solving this problem which can never be completely solved. It seems to me it is largely a matter of attitude, a feeling which must come from within. You of course remember that poem of Leigh Hunt's which starts "Abou Ben Adhem, may his tribe increase."

It concerns a man who dreamed of an angel writing in a book of gold. Its denouement and the point that I want to make are the same. When it came to those who loved their fellow men "Lo, Ben Adhem's name lead all the rest."

In our modern use of words in twentieth century America, "love" does not carry quite the proper connotations of what I have in mind, but substitute for it the word "like" or the verb and adverb "wishes well" and you obtain a more accurate picture of what we must strive for in business today. That is if business as we know it is long to endure.

We must *like* our fellow men and we must *wish them well.* The corporations that operate with this thought sincerely in mind and radiate that good will to employees, customers and investors will find that in their particular bailiwick, like Ben Adhem, their "names will lead all the rest."

PUBLIC RELATIONS FROM STANDPOINT OF A MUNICIPALLY OWNED PLANT

By Howard E. Wolbert

Supplying water to a municipality is not one of the earliest functions of town government; it is one of the necessities occasioned by our advance in civilization. It is a public utility which the municipality has been allowed to finance, principally, for the preservation of public health and, incidentally, for fire protection and manufacturing purposes, but not for the purpose of making a profit. We believe that as a city-owned public utility, it should be managed independent of the general functions of municipal operation.

In the early years a water works enterprise was generally a privately-owned business and operated for profit to its owners. Later, because water works were classed as public utilities, the same as gas and electric plants, telephone companies, railroads, etc., the accounting, financing, rate-making and methods of public service by all such privately-owned public utilities generally were placed under the control and regulation of state commissions, known as "Public Utility Commissions," etc. This was done for mutual protection of the interests of the stockholders and of the public served. This control is now exercised by some form of state commission in nearly every state in this country and these regulating bodies are handing down many authoritative opinions concerning the methods of operation and service by privately-owned utilities. These opinions are, by analogy and often directly, very pertinent to the conduct of the municipally-owned utilities of the present day.

There are two distinct classes of public enterprises: first, those which are called "public utilities" by all competent authorities, and which may be owned and operated by either a private corporation or by a town or municipal corporation; and, second, those which are and always have been called "departments" or functional divisions

---

A paper presented at the New York Section meeting, Poughkeepsie, N. Y., September 22, 1938, by Howard E. Wolbert, Supt., Board of Water Supply, Mount Vernon, N. Y.

of town or municipal government. The failure of town and municipal authorities to keep in mind this fundamental division has been the cause of many failures of municipal ownership of public utilities; such failures are in process at the present time and will continue until some authority above the usual local political governing bodies takes over and exercises the proper and needed regulation, whereby the administration of the public utilities becomes and continues to be a *business* administration, instead of a *political* one.

The water plant of which the writer is superintendent is located in the City of Mount Vernon, Westchester County, New York. It is owned and operated by the city, having been acquired in 1922 by purchase from a private corporation. Mount Vernon is a community of approximately 70,000 people. Its area is small, about 4.21 square miles. Its water supply is obtained from the Catskill supply of the city of New York and is taken by gravity from New York's Hillview Reservoir which is located in the city of Yonkers, approximately one and one-half miles from Mount Vernon's city line.

A considerable part of the population of Mount Vernon is of foreign birth, some of whom are unable to speak understandable English; so it is sometimes difficult to determine just what is in the mind of the water consumer when he or she calls at our office with a grievance. In handling grievances, or other matters pertaining to the water service, the writer tries always to bear in mind that he is a public employee and that every taxpayer or water consumer is his employer and is entitled to prompt and courteous attention. It is sometimes very hard to follow this rule, particularly when the person cannot be made to understand, or simply refuses to listen to explanations. Every water works superintendent has probably had this experience occasionally. We try, however, to see or understand the point of view of the complainant and, while we cannot give way to the complainant's point of view unless he happens to be correct, we try to satisfy him by making a concession of some kind. We find that this is a good policy even though at the outset of the complainant's interview he may be somewhat abusive in his conversation.

When the plant was originally taken over from the private company by the city, we were somewhat handicapped in our relations with the public because of the fact that the company had not furnished really first class service to its patrons. It was some time after the plant became a municipal entity before improved service was furnished to all water consumers. Some of the citizens seemed to

think that the service would be improved instantly after acquirement by the city. But we all know that mechanical improvements cannot be made instantly, and these citizens expressed themselves as being duped after the expenditure by the city of a large sum in purchasing the plant. However, improvements were made as quickly as possible and complaints became fewer and fewer, until today we very rarely receive a complaint due to a mechanical fault of the department. As improvements to the plant were made, we found that our relations with the public improved. Instead of being condemned, we were receiving compliments, until today our problem is mainly adjusting high water bills. We have few complaints from this source, but there are some consumers who complain about the amount of their water bills everytime a bill is rendered, and there are other cases wherein a bill is rendered in an amount several times the average bill of that consumer for several years previous. Naturally, the consumer immediately calls our attention to the high amount of the bill, which, in his opinion, "cannot possibly be correct." In instances of this nature we agree with the consumer that it does seem to be a high bill and we advise him that we will investigate the matter and let him know. We then send an inspector to the premises who examines all the plumbing fixtures to see if any are leaking and, at the same time, checks the meter index. If no leaks are found; the meter reading is found to have been taken correctly; and, our inspector cannot learn at the premises any reason for the increased water consumption, we then check the meter at our testing station. No charge is made for this service. We find that our willingness to investigate the matter of the high water bill, even though we are unable to locate the cause, seems to satisfy the consumer in most cases and the bill is paid without further complaint.

In the majority of cases, however, the high water bill is caused by defective plumbing and we advise the consumer just what fixture is leaking and recommend that the defective plumbing fixture be examined and repaired by a plumber as soon as possible. As a consequence of our willingness to try to help the consumer, whether his grievance is occasioned by a high water bill, a lack of sufficient water due to corroded service pipes, or for any other reason, we believe that our relations with the public, as a municipal entity, are on excellent terms and we believe that by sympathetic attention to the complaints of consumers and fair treatment, together with good service, the relations of any municipal water plant to the public will be beyond criticism.

THE VIEWPOINT OF THE WATER COMMISSIONER

By Joseph J. Plank

The city of Appleton, Wisconsin, purchased the old privately-owned water utility in 1911 and immediately began the construction of a new filter plant and pumping station. Appleton was, I believe, the first city in the state to install an extensive filtering system.

In 1917 the plant was turned over to five citizen commissioners who operated it as the Water Commission. I happened to be one of the commissioners elected by the Council and I have now had this pleasant and instructive position for almost 21 years. When the water department was turned over to this commission, the main thought was that it be kept out of politics, and we at Appleton have fortunately been able to do so.

When the management of the plant was turned over to the commission, the accounting showed it to be about $35,000 in the red. The plant was valued at approximately half a million dollars and had about 2,700 consumers. Today the plant is valued at about 1½ million dollars; we have 7,000 consumers; we pay taxes just as does a private utility; and since 1923 the water department has paid the city a 5 per cent return on its investment, the return amounting to over $600,000. We have set aside a depreciation reserve which now amounts to over $300,000 and we are one of the few utilities in the state which maintains this fund in government and municipal securities which can be turned into cash at almost a moment's notice, should the need arise. During the past 18 years, this fund has earned over $90,000 in interest. We also have reduced rates several times and we try to operate at just a little over cost basis.

Let me say this to you who are all connected, more or less, with governmental affairs: A little money can be, and should be, set aside for emergencies. The tendency in this age in federal, state, county and municipal affairs is to spend and borrow, and spend some

---

A paper presented at the Wisconsin Section meeting at Milwaukee, Wis., October 11, 1938, by J. J. Plank who is a substantial business man of Appleton, Wis., and who has devoted many years of service as a member of the Water Commission.

more and borrow some more, with no thought of spending within one's income. Living within an income can be done; we have proven it. Should any emergency arise, should a building be seriously damaged or should a new engine be needed, we would have the cash to meet the expense and we would not have to provide for the outlay by additional taxes. Let me ask you to bear this in mind: Live within your budget and set aside a little for emergencies.

I know that all your municipally-owned water works set aside a depreciation reserve, but in most instances it is spent for some improvement, and should an emergency occur, the municipality would have to provide the funds necessary to meet it.

Our Appleton Commission has run the water department on a strictly business-like basis. The ownership is vested in the city. Main extensions and major improvements are made by the city and paid for out of the general fund. These costs are added to the city equity and dividends are returned to the taxpayer, just the same as in the case of any investment made by an individual or bank.

We send to each councilman a copy of the minutes of our semi-monthly meeting and a copy of our monthly financial and plant report—so the Council is constantly informed as to our proceedings. The management of the plant, improvements, investing of funds, hiring of department heads, wages, etc. are entirely in the hands of the water commission.

The water commission meets twice a month. Our operations are divided into three departments: purification and pumping in charge of Mr. Gallagher; distribution, meters, etc. in charge of Mr. Tornow; and office in charge of Mr. Demick. These men attend each commission meeting and are therefore conversant not only with their own departments but also with each others and with the workings of the commission. One commissioner takes special interest and gives special attention to the filter plant and pumping station, another to distribution, one to office, and one to council relations.

The commission must, of course, look to the department heads for suggestions as to improvements needed or policies to be carried out. The commission acts as a board of directors and it discusses all problems and makes the decisions. It is then the responsibility of the department heads and their employees to carry out the policies. It is, of course, most essential that harmony exist among the commissioners themselves and among the various departments. No business can thrive if all do not pull together.

The above should give the reader an outline of the workings of our commission. We have found our plan to work out splendidly and have had the most hearty cooperation of our department heads. We are always looking for improvements and welcome suggestions and discussion.

The viewpoint of a water commissioner should, first of all, be in the interest of service to the public. He should see that all departments are kept in tip-top shape, consistent with income. He must, of course, attempt to keep rates as low as possible, consistent with first-class service and he must watch expenses so that they always remain within the income of the utility.

There is one thought that has frequently occurred to me, but which we have not worked out in Appleton. That idea is that we should advertise our product. Water is so cheap, and it seems that some ideas could be worked out to get people to use more of it, and thus increase our income. All other utilities, electrical, gas, transportation, etc., advertise, but I have never heard of a case of an extensive advertising campaign by a water utility. Some advertising to promote water consumption might help situations in our cities comparable to that described in the story in which a midwestern agriculturist is said to have installed a water system in his home and ordered the fixtures, including the bath tub, from a mail-order house. In some way the shipment was mis-sent and it did not reach him until fall. The old gentleman promptly returned the bath tub, with a letter stating that he was very much put out about the delay but, seeing how winter was coming on, he would not be needing the tub.

Water works men, whether purification men, operators of plants, or office executives, all have done a splendid job in Wisconsin. This Association and its conventions and meetings have done an enormous amount of good in spreading ideas among the various communities.

The public should appreciate the work water works men are doing to provide better and safer water and adequate fire protection. Water is, next to air, most essential to man, and water works men are on the job to have it ready 24 hours a day, 7 days a week throughout the year. As a water commissioner, my hat is off to the water works man.

OPERATING A SMALL WATER WORKS PLANT

By L. E. McQueen

Looking through the Michigan Department of Health Engineering Bulletin 12, as revised to January 1, 1938, we find that there are 339 public water supplies in this state. These supplies serve 3,554,000 or nearly 75 per cent of our 4,842,000 population. Of these 339 water supplies, 34 serve 2,934,000 in communities of 10,000 population and over. By the simple process of subtraction we find then that there are 305 public water supplies serving 620,000 persons in communities of less than 10,000. In other words, 90 per cent of the plants serve 12½ per cent of the population. Further study shows that 255 or 75 per cent of the 339 public water works of Michigan use ground water as their source of supply, developing it for their use usually through the medium of wells and delivering it to the consumer, in the majority of cases, without treatment of any sort. Most of these 255 ground water users fall in the small water works class, as defined above.

From this it is readily seen that, numerically, a large majority of the public water works of Michigan are operated in communities of less than 10,000 population and that the bulk of these works use ground water as their source and deliver the water without treatment to their customers.

The public water supply located in Coldwater, a community of about 7,000 population, is municipally owned and is probably representative of this large group of small supplies.

It is the purpose of this paper to present the history and a description of the operation of this representative small water works property, touching upon some of its problems and commenting on their solution, to the end that we may review these matters which are the daily concern of the small operator.

Financed by a $75,000 bond issue, the city of Coldwater began the

---

A paper presented at the Michigan Section meeting, Saginaw, Mich., September 14, 1938, by L. E. McQueen, Supt., Board of Public Works, Coldwater, Mich.

construction of its public water supply in 1890, placing the control of that property in the hands of a Board of three Water Works and Electric Light Commissioners who were elected to cascading terms of office by the Mayor and Common Council. This Board also was charged with the management of the municipal electric plant which was purchased from a private company in 1891, at about the time the newly constructed water works began to supply regular service.

This Board existed from 1891 to 1903 or about 12 years, employing three different superintendents during that period. In 1903 a five man Board of Public Works inherited the duties of the Board of Water Works and Electric Light Commissioners, adding thereto the operation and maintenance only of the sanitary sewer system of the city. This is, at present, a minor activity, financed through general tax revenues and involving but $1,200 to $1,800 in expense annually.

MANAGEMENT AND PERSONNEL

For the past 35 years the Board of Public Works has carried on the management of these various properties, employing five different superintendents, including the writer who has served in that capacity for the past 22 years. Including the present members, 36 men have served on these two boards, many of them for long periods, terms of 15 to 20 years or even longer being not uncommon. This has resulted in a very stable and satisfactory management, permitting long programs of policy and development to be devised and carried out.

In addition to the employment of a superintendent who is the active manager of all of the works under the Board's control, consulting engineering service has been employed on nearly all major improvements that have been undertaken since the city entered into this utility work.

The superintendent is responsible for the employment and training of the entire personnel, who are charged with the details of construction and operation of all of the activities in which the Board functions.

We have found the property to be too small to permit of departmentalization as practiced in larger places and have discarded that plan for one in which employees operate in groups, all employees of each group being trained in a variety of work. We have found it necessary to prevent employees from becoming obsessed with the

idea that their duties start and stop at some given point or are confined to one activity. Like the Foreign Legion, our motto is "All for One and One for All."

While there may be a better plan, this one has produced an efficient, loyal organization, a minimum of labor turnover and a quality of service which is our answer to all critics, and which forms our greatest asset in establishing customer good will.

Since the beginning, the water and electric plants have been located at the same point and have been operated by the same group of employees, all of whom are selected by, and are under the direction of the plant chief engineer. In addition to the production plant properties this group handles our 35-acre Water Works Park which is adjacent to the plant and forms our well field. Automotive service work, major tool and equipment maintenance and all heavy shop work are cared for by this same group.

Two distribution foremen are responsible for all construction and maintenance activities external to the plant itself. These men are permitted a voice in the employment of their assistants and are trained through years of experience in all branches of activity, including plant work. During the winter and at other periods when inclement weather makes outdoor work impracticable, these groups are used for major plant maintenance work such as cleaning, painting, building and equipment repairing, and other work of a similar sort which is purposely scheduled to take up the slack periods.

A service group, centered around the assistant to the superintendent, is employed by the superintendent. This group is responsible for all service activities such as establishing and cutting off of supply, maintenance of metering equipment, inspection of all sorts, complaint and trouble work, testing and survey work, free service activities, handling of supplies, sale of merchandise and labor, in fact all work not covered by the other groups enumerated.

The office is in charge of a chief accountant who has three assistants plus a part time man who cares for all meter reading and collecting. The members of this group are employed by the superintendent and are charged with all of the activities of meter reading, billing, collecting, banking, bookkeeping, cost accounting, and stenographic work.

We find that this group system of organization has worked very well, from the time that our permanent staff consisted of but 12

persons up to the present when 27 persons are so engaged, and has always permitted of ready expansion to meet periods of exceptional activity.

The city of Coldwater is approximately 2 miles square and occupies a fairly level site which tilts somewhat to the west and north. In this area the limestone bed rock carries an overburden of glacial deposit consisting of shale, sand, gravel and clay ranging in thickness from 100 to 150 feet. This overburden is permeated with a good quality of ground water which normally stands within 10 to 20 feet of the surface. This ground water has a moderate movement to the west and north, the same as the tilt of the earth and the flow of the neighboring streams.

The engineers responsible for the original selection chose as a point for supply and plant location a 40-acre tract adjacent to the then built-up area and located upon the southeast or upstream side of the city. At this point they found a satisfactory quantity of water with a quality typical of other waters of the area. The most pronounced features of this water are a hardness of 300 to 325 and an iron content of .68 to 1.31 parts per million.

GRAVEL WALL TYPE WELL RATED AT 5 M. G. D.

Primary development was effected with 6-inch tubular wells and brass strainers. These were retired after a useful life of but 12 to 16 years. Following this, two masonry type dug wells, 30 feet in diameter by 38 feet deep, were installed. With some alterations in 1916, these are in regular use today, being 32 and 36 years old respectively These wells have a firm capacity of 2,000,000 gallons per day and represent an original investment of $4,700 per million gallons capacity.

In 1930 a 26-inch well of the gravel wall type was installed to a depth of 128 feet and tested at a continuous pumping rate of 7,000,000 gallons per day. We rather conservatively rate this well at 5,000,000 gallons which represents an investment of but $2,500 per million gallons capacity. With the present demand ranging from $\frac{3}{4}$ to 3 m.g.d., the supply appears ample and presents no particular problems unless it possibly be one of treatment for hardness and iron removal.

The original pumping equipment which operated from 1890 to 1916 consisted of two direct acting, duplex pumps with tandem compound steam cylinders. These pumps received steam from the

boiler plant, which was common to both the water and electric systems, and exhausted to atmosphere. Pumping from the wells was by direct suction and these units discharged directly into the mains. Since 1916 all pumping has been accomplished with horizontal split case type motor-driven centrifugal pumps, similarly directly connected to wells and mains.

In 1924, further improvement was effected by the installation of a 300,000 gallon elevated storage tank. This storage is so arranged that water levels are maintained between two points through automatic control of the pumps, the head on the distribution system ranging from 45 to 55 pounds. Before this tank was installed, the current used in pumping amounted to an average of 1.13 kw. hr. per 1,000 gallons, and after installation this dropped to .73 kw. hr. per 1,000 gallons. This has been still further lowered in later years, through the use of newer and more efficient pumps, until the present annual average is .67 kw. hr. It might be of interest to note at this point that the average cost of electric current used in pumping for last year was 16 mills per kw. hr. or slightly less than 11 mills per 1,000 gallons pumped.

When this tank was installed, the piping was so arranged that all mainline station meters can be regularly tested by using the tank as a calibrated receptacle for the water. From the very beginning, all pumping installations have been designed to the end that pressures can be increased at times of fire to 90 or 100 lb. Even though our volunteer fire department is now liberally equipped with pumping equipment, they still would rather fight fires with city water fire pressure than connect their own apparatus. We hope eventually to induce them to abandon this idea and the hazards that are associated with it. All water is delivered to the mains without treatment and is furnished to the customers with but few restrictions as to its use.

DISTRIBUTION

Many times we have thanked the designing engineers and local civic group for a well arranged and liberal sized distribution net work. The original system consisted of: 66,500 feet of 4- to 12-inch class C cast-iron, bell and spigot watermains with 100 fire hydrants and 93 gate valves. These quantities are now increased to 153,700 feet of 4- to 12-inch Class C and class 150 main with 193 fire hydrants and 383 gate valves, or 1 hydrant to each 797 feet and 1 gate to each 402 feet of mains.

In the earlier improvements to the original system a considerable amount of inadequately sized water main was installed. In recent years this has all been replaced and the system otherwise renovated, especially as to hydrant size, location and spacing; valve uniformity and arrangement; and the elimination of unnecessary dead ends.

Practice for some years past has been to manhole all new valves, all old valves over 6 inches in diameter as well as all valves in paved areas. It is also present practice to valve separately all fire hydrants. At the present time over 52 per cent of all valves are manholed and over 38 per cent of all hydrants are valved and manholed. Twenty-three blow off connections serve the dual purpose of flushing deposits from the water mains while at the same time cleaning deposits from the storm and sanitary sewer systems into which they discharge. A minimum number of fire hydrants is used in flushing the system.

We have, without apparent harm, used our water mains for many years as a source of grounding for our entire electrical net work, our station ground being buried under the water in one of our dug wells.

SERVICES

There are 2,250 water customers supplied through service pipes ranging in size from $\frac{3}{4}$ in. to 6 in. and laid to a depth of 5 feet of cover. All services are constructed to and valved at the property line by the water department for a fixed tap fee which has been unchanged since the water department was started. From this point all services are constructed at the expense of the property owner.

From 1891 to 1920 services were installed with wrought iron or steel pipe and wiped lead goosenecks. The earlier services were of black pipe and the later ones of galvanized pipe. The average life of these services is 25 to 35 years. At the present time about 40 per cent of the existing services are of this type. Since 1912 all services under paved streets and since 1920 all services under 2 in. in size have been installed with extra strong lead pipe, the earlier ones with wiped connections and the later ones with flanged connections. Services of 2-inch size and larger are all of cast iron.

The smaller services cause some trouble on account of stoppages caused by a fairly solid deposit. This can be successfully removed and the service restored to its original capacity by means of a small, hand-operated back pressure pump. This work is done by and at the expense of the department, the operator making his connections in the basement of the property serviced. It is seldom that we find it necessary to dig up a service to remove the stoppage.

Maintenance of all plant and distribution property is simplified by periodic inspections and operation. At the time of these inspections such painting as is listed in the schedule is cared for. These periodic inspections are found to be of greatest value in maintaining pumps, valves and hydrants. Not many years ago it was not at all surprising to find as many as 30 per cent of the distribution shut-off valves out of order and many hydrants standing full of ice or inoperative when needed during the winter months.

We have experienced three different seasons of severe freezing, with considerable outage of services and small mains on account of ice formation. These have always been restored promptly by means of electrical thawing, using the transformer method. Our close association in the electric plant operation makes this very practicable. Our thawing practice has been to make no charge for the first call but to bill the customer a nominal fee for all repeat calls which we feel are due to his negligence.

We experience wide fluctuations in consumption which vary from ¾ to 3 m.g.d. with total pumpage figures ranging between 600,000 and 2,500,000 gallons. The average consumption per capita per day ranges from 92 to 150 gallons. The 92 gallon figure was for last year and this year consumption per capita is expected to go even lower. These wide fluctuations are easily met with our ample supply and liberal pumping capacity, the low cost of pumping limiting the annual fluctuation in operating expense to about $2,000, an amount which is easily within a fraction of the margin of profit in which the department operates.

RATES AND BILLING

Regular service is furnished to residential and simple commercial users at flat rates which account for approximately 83 per cent of the total revenue. These rates are based upon a schedule of fixture charges, the accuracy of the fixture count being maintained by the service department which checks all properties at stated intervals such as when routine electric meter tests are made or when service is being turned on or off. These rates are collected semi-annually, in advance, and supply complete water service to the average flat rate user at a cost of 73 cents per month.

The balance of the service, accounting for 17 per cent of the total revenue, is furnished at metered rates which range from 9 cents to 5.4 cents per 1,000 gallons, producing an average cost to the user of slightly less than 6 cents per 1,000 gallons. This metered billing is

handled on a monthly basis and in a manner directly comparable to that in which the electric service is handled.

In order to maintain accurate metering it is found necessary to overhaul and test all water meters on a 4-year schedule.

No revenue is received from water service furnished to the municipality for fire protection, street work, public fountains, sewer cleaning, and for use in the city building. All other public properties pay the scheduled rates. These include federal, state and county buildings and institutions, as well as the city library, cemetery, parks and schools. The city electric plant is the water department's largest single customer. No rate concessions or special rates are given to any consumer of any description. Collections are made promptly and no delinquency is permitted. Losses from uncollected water accounts average less than $\frac{1}{10}$ of 1 per cent of the gross billing.

FINANCIAL MANAGEMENT AND ACCOUNTING

In a paper of this sort, tabulations of figures may be of little interest or value. It is, however, desirable at this point to call attention to the small sums which are involved in the operation of a small water supply such as has just been described.

Referring to the latest annual report we find the following which may be of interest: (1) The total investment in fixed property amounts to $303,768 or $135 per customer. This amount has been depreciated to a present book value of $144,343. There is no indebtedness on the property. (2) The total annual income amounted to $23,156 with operating expenses amounting to but $10,610. (3) The net operating revenue of $12,546 plus non-operating revenue of $1,857 produces a total net income of $14,403 or 57½ per cent of gross income. (4) Of this amount $6,962 was set aside for depreciation reserve, while the balance of $7,441 was carried to surplus. (5) Surplus accounts in the form of cash and federal bonds total $72,576 at this time. In addition, the water department has contributed, in cash, $11,000 to the General City Improvement account during the past ten years.

Judging from these figures it might be assumed that substantial water rate reductions are now in order. This would be a fair assumption except for a Board policy of several years standing. This policy centers about the idea that a water treatment plant or a sewage disposal plant, or even both, might be built within the near future. In the latter case it is planned that the water department

and sanitary sewer department would be merged into a joint utility. To provide for this possible contingency, water rates have been held fairly constant, with total reductions of approximately 18 per cent during the past ten years, to the end that a fund of $100,000 to $150,000 be built up in anticipation of such improvements.

Until 1925 all accounting in the municipality was kept upon a receipts and disbursements basis, being handled by the city clerk and city treasurer, the water department employees having but little voice in this important phase of their operations. Mounting activity and a demand for adequate cost records, especially in the electric department, brought about a change which resulted in all of the accounting, banking and associated operations being taken over by the Board and placed in the hands of its superintendent.

A firm of certified public accountants was engaged to set up a system of accounts for both the water and the electric departments. This system was to conform to that which was in general use in private electric utility practice as of that period. The accounting was to be set up separately for each of the Board's several activities.

The system so installed worked out to our entire satisfaction and would be in effect today except for the development of a new uniform system of accounts by the Federal Power Commission for its electric utility licensees. This system was made mandatory upon all municipal electric utilities in Michigan by the Michigan Public Utilities Commission as of January 1, 1938.

Without concerning ourselves with the Commission's authority and power to enforce such an order, we elected to adopt the new system in an effort to cooperate in these laudable efforts to create a nation-wide uniformity in utility accounting. Using our own office staff, we set up this new Federal Power Commission system as of April 1, 1938. While doing so, we set up a water works system in a parallel manner, all divisions of accounts and account numbers being as nearly as possible symmetrical for the two utilities. By setting a prefix ahead of the electric account numbers we provided for identification of the water account numbers. We feel that this new system will be an improvement over that which we have been using.

THE ARLINGTON COUNTY WATER SYSTEM

By A. T. Lundberg

This paper will describe the metropolitan idea as applied to the development of water service for the suburbs of Washington, D. C., in Arlington County, Virginia. The suburban area includes Arlington County, a portion of Fairfax County and the city of Alexandria. Included in the Fairfax County portion are the towns of Falls Church, Fairfax and Herndon. The water supplies involved are all municipally owned, with the exception of the city of Alexandria which is a privately owned system supplied by impounding reservoirs, fed by small streams, and followed by filtration and chlorination. The water supply for the towns of Falls Church, Fairfax and Herndon is obtained from deep wells. The Arlington County supply is obtained from the City of Washington Supply through the Dalecarlia Filter Plant which is under the supervision of the United States Engineers Office.

Arlington County is directly across the Potomac River from Washington, being that portion of the original area of the District of Columbia, except the area included in the corporate limits of the city of Alexandria, which was receded to the State of Virginia by Congress in 1846, and was then called the county of Alexandria. Due to the confusion between the city of Alexandria and the county of Alexandria, the name of the county was changed to Arlington in 1920.

The area of Arlington County is 23.5 square miles, and it has a population of approximately 41,000. Since January 1, 1932, Arlington has enjoyed the County Manager form of government with a County Board of five members, elected at large. This is similar to the City Manager-Council form of government.

In 1926 when the question of a county-wide and county-owned water system came up, there were approximately twenty small

---

A paper presented at the Four States Section meeting at Washington, D. C., October 6, 1938, by A. T. Lundberg, Ch. Eng., Arlington County Water Dept., Arlington, Va.

communities located in the county's three magisterial districts, Washington, Jefferson, and Arlington. Five independent privately owned distribution systems, with well supply, were in operation in Cherrydale, Livingstone Heights, Bon Air, Virginia Highlands and Aurora Hills. Four of these systems were of steel pipe from 1½ in. to 3 in. in diameter, without meters; the Aurora Hills system was of cast-iron pipe from 4 in. to 8 in. in diameter with meters on each service connection.

During that year the Board of Supervisors of Arlington County employed Asa E. Phillips, as consulting engineer, to investigate and report on a county-wide water system. The major problem was to provide an adequate supply of water economically. With this in mind, the possibility of getting water from the federal supply was agreed to be the proper solution. A committee was appointed by the Board of Supervisors to contact the U. S. Government for the purpose of obtaining this supply. This was done with the result that there were two Acts passed by the 69th Congress, one authorizing the sale of water from the federal water supply, and the other authorizing the connection of the Arlington County water system to the federal water system.

Estimates, covering the construction of a water distribution system, steel reservoir, tower, pump house and operations building, were prepared totaling $750,000, It was necessary, after approval by a vote of the people, to issue bonds in this amount. The authority of the county in constructing the water system was covered by an enabling act in Chapter 260, Acts of the Assembly of Virginia, 1922. Chapter 284, Acts of the Assembly of Virginia, 1926, provided the authority to issue bonds for the construction and operation of a water supply in counties having a population of 300 inhabitants per square mile.

The bond election for the $750,000 issue, authorized by the Board of Supervisors on May 19, 1926, was held on June 15, 1926, and carried. A resolution to issue $750,000 of water bonds in Arlington County was passed by the Board of Supervisors on December 30, 1926. These were five-year term bonds, maturing as follows: $100,000 on Dec. 1, 1935; $150,000 on Dec. 1, 1940; $250,000 on Dec. 1, 1945; and $250,000 on Dec. 1, 1950.

Plans for the complete system were authorized January 28, 1927. The plans called for a 24-inch supply line from the Dalecarlia Filter Plant to Chain Bridge where, due to the condition of the bridge, it

was necessary to reduce the 24-inch main to two 8-inch steel mains. These steel mains were increased to a 24-inch cast-iron main on the Virginia side of the Potomac River, and this main was run to the intersection of Glebe Road and Military Road where a 12-inch cast-iron main was constructed along Glebe Road to Lyonhurst Station, the site of the steel reservoir and tower. Distribution through the supply mains was made from this point. Construction started in the spring of 1927.

The report of Asa E. Phillips, dated May 10, 1928 and covering the original project, is shown in table 1. The total cost of $636,110.69

TABLE 1

Summary of cost, May 10, 1928

ITEM	SIZE	LENGTH	COST
1. U. S. Government Main	24 in. and two 8 in.		$70,718.39
a. Project "A"—Supply Main	24 in. and 12 in.	30,000 ft.	134,864.28
b. Project "B"—Supply Main	12 in.	40,000 ft.	115,865.82
c. Project "C"—Supply Main	12 in.	40,000 ft.	134,462.20
2. Reservoir, Tower, Buildings, Land and Pumps			71,000.00
3. Service Mains	8 and 6 in.	70,000 ft.	95,000.00
4. Fire Hydrants		191	
5. House Connections		340	
6. Contingencies			14,200.00
Total			$636,110.69

covered the installation of approximately 36 miles of supply and service mains, a 1,500,000-gallon reservoir, a tower with a capacity of 260,000 gallons, pumps, and a pumping station.

During the following year the County continued to install water mains in the densely populated areas with the balance of the proceeds of the original bonds issued. Fire hydrants were installed from the proceeds of five-year notes issued in the amount of $50,000, which was a part of $100,000 authorized by a special act (Chap. 51, Acts, 1927) of the Assembly of Virginia. The balance of the notes was not issued because additional funds were not required.

All water mains installed since have been financed without issuing

additional bonds. A summary of both mains and service connections installed after June 30, 1930, is given in table 2.

Projects completed since the original include two major items, (1) the construction, at a cost of $40,000, of a 20-inch main on Military Road from the 24-inch main on Glebe Road to Lee Highway, through which approximately two-thirds of the county is served by gravity from the federal supply, and (2) the recent installation of two 20-inch steel mains on the new Chain Bridge across the Potomac River, costing $46,000. The two 20-inch mains will provide a supply of approximately 25,000,000 gallons of water per day for Arlington County. These two items were financed without issuing additional bonds.

TABLE 2

Cumulative summary of mains and service connections

YEAR ENDING	MILES OF WATER MAINS	*SERVICE CONNECTIONS
June 30, 1930	61.14	1,914
June 30, 1931	83.90	3,312
June 30, 1932	86.76	3,878
June 30, 1933	87.00	4,144
June 30, 1934	91.80	4,435
June 30, 1935	105.43	4,997
June 30, 1936	116.00	5,887
June 30, 1937	130.60	6,881
June 30, 1938	140.00	7,870

* Includes Domestic and Commercial Connections.

The projected work planned by the Arlington County Water Department includes a storage reservoir of sufficient capacity to provide water for approximately thirty-six hours, additional pumping equipment, and additional supply mains. This work will be covered in a five to seven year program in order to finance the construction cost without a bond issue.

The bonds issued in the amount of $750,000 and the note for $50,000 covered three distinct phases of the project, namely, the construction of a water system, the installation of fire hydrants, and the installation of service connections to the property served. The liquidation of this obligation is provided by water department revenue.

For the construction and use of any cast-iron water main in the

system, a charge of one dollar per front foot is made, payable in cash at the time of installation, and, if not paid, carries an interest charge of 6 per cent for a period of ten years. This item of one dollar per front foot is not an assessment which is collected as a special tax, but is a water department charge collected by the County Treasurer at such time as the property owner elects to pay the same. Payment must be arranged before a tap is made for the property. At the present time water main extensions are made upon request under a definite financial arrangement. Domestic water rates as adopted in 1927 and as now revised are given in table 3. Domestic consumers are billed quarterly, the minimum charge in advance together with any excess used during the previous quarter. Table 4 shows the commercial rate. Commercial consumers are billed monthly for

TABLE 3

Domestic water rates

DATE	MINIMUM CHARGE	CONSUMPTION ALLOWANCE	EXCESS RATE
Feb. 28, 1927	$27.00 annually	40,000 gal.	.30 per 1,000
June 1, 1928	24.00 annually	40,000 gal.	.30 per 1,000
Jan. 1, 1933	5.00 quarterly	10,000 gal.	.30 per 20,000
			.25 next 20,000
			.22 over 50,000
July 1, 1936	4.50 quarterly	12,000 gal.	.27 first 20,000
			.22 next 20,000
			.20 over 52,000

water used during the previous month. Service charges are billed in advance quarterly.

The cost of water delivered to Arlington County by the U. S. Government from Dalecarlia was $65 per million gallons in November, 1926, $55 in January, 1929, and the present rate of $50 per million gallons has been in force since December, 1933.

At the present time the original obligation of $800,000 has been reduced to $635,000. The operating plan of the water department provides for a monthly sinking fund contribution sufficient to amortize the bonds at maturity. Semi-annual interest payments are provided from current operating revenues.

The tapping charges for either a domestic or commercial service together with the installation of the meter and the service line to

the property line are covered by a set schedule of rates as follows: for a ¾-inch service line and ⅝-inch meter, $40; for a 1-inch line and ¾-inch meter, $50; for 1½-inch line and a 1-inch meter, $60; for a 2-inch line and 1½-inch meter, $100; and above a 2-inch line, a cost of not less than $100. The service line from the property line to

TABLE 4

Commercial water rates

DATE	ANNUAL SERVICE CHARGE	WATER RATE
Feb. 28, 1927	⅝ in. meter— 3.00	
	¾ in. " — 12.00	1st 20,000—¾ dom. rate
	1 in. " — 21.00	Next 100,000—7/12 dom. rate
	1½ in. " — 48.00	Over 120,000—½ dom. rate
	2 in. " — 83.00	
	3 in. " —192.00	
	4 in. " —340.00	
Mar. 9, 1928	Same as for Feb. 28, 1927	.30 per 1,000
		Over 400,000, service charge waived
	QUARTERLY SERVICE CHARGE	
Jan. 1, 1933	⅝ in. meter— 1.50	
	¾ in. " — 2.00	1st 20,000—.30 per 1,000
	1 in. " — 4.00	Next 20,000—.25 per 1,000
	1½ in. " — 9.00	Next 50,000—.20 per 1,000
	2 in. " — 12.50	Over 80,000—.18 per 1,000
	3 in. " — 25.00	
	4 in. " — 45.00	
July 1, 1936	⅝ in. meter— 1.50	
	¾ in. " — 2.00	1st 10,000—.27 per 1,000
	1 in. " — 4.00	Next 20,000—.23 per 1,000
	1½ in. " — 9.00	Next 50,000—.18 per 1,000
	2 in. " — 12.50	Next 70,000—.16 per 1,000
	3 in. " — 25.00	Next 100,000—.13 per 1,000
	4 in. " — 45.00	Over 250,000—.10 per 1,000
	6 in. " — 60.00	
	8 in. " — 75.00	

the dwelling or other building is constructed by a registered plumber employed by the property owner. The line is inspected by the plumbing inspector under the supervision of the County Health Department.

Sprinkler service connections are permitted on the system. The

water department makes the installation from the main to the property line with a valve at the property line. This work is billed to the owner at cost. Meters are not installed on sprinkler connections, and the charges are yearly in advance as follows: 2-inch connections, $20 per year in advance; 3-inch, $30; 4-inch, $40; 6-inch, $50; and 8-inch, $60.

At the present time the Water Department is operating under a definite set of rules and regulations approved by the County Board on April 14, 1938. A few of the provisions set forth in these regulations are described below.

ARRANGEMENT MADE FOR PERMANENT MAIN EXTENSION

A permanent water main is installed at the request of the recorded owners of the abutting property upon the completion of the required arrangements. The owner, or owners, of the abutting property along the street on which an extension is requested must submit to the water department the location of the property to be served, and an estimate of the cost of construction is then prepared. The property owners are advised of the estimated cost, less the cost of fire hydrants. In the event it is necessary to install a water main larger than six inches for distribution purposes, the estimated cost to the owners for arrangement is computed on the basis of a 6-inch cast-iron main. The owners of abutting property must provide signed up frontage at the rate of one dollar per front foot in an amount equal to the estimated cost. In the event the total available frontage at one dollar per front foot is less than the estimated cost, the water main is installed when the total available frontage is arranged. Permanent water main extensions are made only on dedicated streets which have been rough graded or on easements and rights-of-way dedicated to the County.

When a water main extension is requested on a street, one side of which is subdivided and the opposite side is unsubdivided acreage, the water department may extend the water main when the total available frontage on the one side is paid in cash, and immediate taps are made at the rate of one tap per seventy-five feet of water main installed.

Temporary water mains may be installed only when a permanent cast-iron water main extension can not be arranged. The water tapping agreement is not signed until execution of the regular temporary agreement covering the frontage of the property served by

the temporary water main which provides for the payment of the front footage charge when a permanent cast-iron water main is installed. Temporary water mains are installed by a registered plumber under the supervision of the water department and subject to the conditions set out in the agreement.

The installation of service connections is of copper, brass or cast-iron depending upon the size of the service required. The tapping charge covers a complete installation to the property line, with the meter set in a meter box with cover. The meter box, which is made up with an 18-inch concrete pipe 24 inches long and a manufactured cast-iron cover, is placed either in the sidewalk or between the sidewalk and the curb. The service line is constructed to the property line in a trench four feet deep.

The design of the original Arlington County Water system, and the plan provided for financing it have worked out well in the expansion which has taken place since 1926. The system has been enlarged steadily both in the extension of its distribution mains and the service connections. With the installation of a county-wide sewerage system and sewage treatment plant completed in 1936, the demand for water service has increased to such an extent that we are now adding approximately one mile of water main and one hundred service connections per month.

The operation of the original project was under the supervision of C. L. Kinnier, now County Engineer, from whom the writer received considerable data in the preparation of this report. The writer also wishes to acknowledge the aid of E. F. Newell, County Auditor, under whose direction a complete record of the financial status of the water department has been maintained.

FIRE PROTECTION ELEMENTS OF WATER WORKS

Relative to Fire Protection Classification

By Sanford Herberg

Throughout the ages the principal fire extinguishing agent has been water. It still is. It is true that certain other liquids, gases and powders can be and are used for small and incipient fires, but, for the extinguishment of the large fire or retarding and stopping conflagrations, water has no substitute.

The fire protection elements to be discussed are all considered in the process of grading a fire protection system and the requirements for each will be based on the standards of the Fire Underwriters schedule known as the "Standard Schedule for Grading Cities and Towns of the United States with Reference to Their Fire Defenses and Physical Conditions."

The major features considered in the schedule are the water supply system and the fire department. The weight assigned to these two features is 34 per cent for the water supply and 30 per cent for the fire department. The other features of the fire protection and fire prevention make-up comprise the remaining 36 per cent. These include the fire alarm system and police forces, the fire protection and fire prevention regulations applying to existing properties and structures in process of erection. Included also in this percentage is the consideration from the fire fighting angle given the general type of construction and general condition of buildings constituting the principal mercantile or high value districts which are to be protected. The water supply and fire department features together, therefore, account for 64 per cent of the fire defenses.

Water works systems usually serve two purposes, one being the furnishing of water for domestic and industrial use, the other, providing water for fire fighting purposes. It is quite difficult to determine exactly what proportion or percentage of the system should

---

A paper presented at the Minnesota Section meeting, Minneapolis, Minn., September 29, 1938, by Sanford Herberg, Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

be chargeable to fire protection. It is certain, however, that for reasonably good protection, the percentage chargeable to fire protection is much greater for a small town than a large city. This seems reasonable when it is considered that the fire flow required in a small town generally exceeds the domestic and industrial water demands and conversely in the larger cities the domestic and industrial demands far exceed the fire flow requirement.

BASIC REQUISITES COMMON TO BOTH SERVICES

These two services have certain elements in common. The principal requisites for either type of service are that the system be adequate and reliable. From the standpoint of domestic and industrial service it is easy to see the advantage if, due to its adequacy, it will furnish all the water necessary and at the pressure desired for domestic and industrial use, lawn sprinkling, street flushing, etc., and, further, if due to its reliability it will furnish this water at any and all times and under any conditions. Likewise, the qualities of adequacy and reliability are important from the standpoint of fire protection. Therefore, if the quality of the water which is important from the standpoint of domestic and industrial use is disregarded, it can be stated generally that properties of a water works system which are good for the fire protection service are also of advantage to the domestic and industrial service.

The demand for water for domestic and industrial use is continuous, whereas by the standards it is assumed that the demand for fire protection purposes will be for limited periods of time constituting the probable duration of a large fire. For cities over 2,500 population this period is arbitrarily assumed as ten hours and for towns below this population it is assumed as five hours. It is possible, therefore, for municipalities with supply works and pumping capacities only slightly in excess of the maximum domestic and industrial demands to meet the fire protection requirements by providing water storage of sufficient capacity to furnish the necessary fire flow during these periods of time. It is ordinarily found that the structural conditions in towns and cities of the same population and size are closely similar and so the use of a fire flow formula which is based on the population of the city or town will give fairly accurate results in determining the amount of fire flow necessary. Of course, if the structural conditions are unusual and do not classify as average for the size of the city, the results of the formula are changed accordingly.

FORMULA FOR FIRE FLOW

The formula used resulting in gallons per minute is $1020\sqrt{P}(1-.01\sqrt{P})$. "P" is the population in thousands. Using this formula the fire flows required for towns of various populations are as shown in table 1. The fire flow results obtained from the formula apply to mercantile and congested value districts. In other districts the required fire flow would vary from 500 gallons per minute in a partly built up residential district to amounts approaching the flow required in the congested value district for other districts where increased congestion and larger residential buildings exist.

It should be noted that these fire flow figures are for fire protection purposes only and are in addition to the amount of water required for domestic and industrial demands.

TABLE 1

Fire Flow for Cities According to Population

POPULATION	FIRE FLOW IN GAL. PER MIN.
1,000	1,000
2,000	1,500
4,000	2,000
6,000	2,500
10,000	3,000
17,000	4,000
40,000	6,000
80,000	8,000
125,000	10,000
200,000	12,000

The next item to be considered is the pressure at which the required quantity shall be furnished. If the fire department in the town under consideration has little or no fire department pumping equipment, that is, if the fire department pumping capacity is considerably below the requirement, it is necessary that the water works pumping equipment be so designed and the elevated storage sufficiently elevated to maintain pressures at the hydrants which are sufficient to furnish direct hydrant streams. Sixty pounds is about the lowest hydrant pressure at which hydrant streams can be furnished for a district which is in the least congested and where some buildings are three stories high. For districts of greater congestion and containing taller buildings, 75 pounds pressure and considerably more should be

furnished. If a town has or intends to install fire department pumping equipment complying with the requirements in capacity, the pressure on the system can be less, but the static or the normal pressure should be sufficiently great to maintain at least 20 pounds pressure in the water mains in any portion of the system when furnishing the required fire flow.

In determining the adequacy of the supply works, consideration is given to all portions including the supply, intake and suction lines, well pumps or low-lift pumps, filters, high-lift pumps and discharge lines. Water storages, such as clear water reservoirs, other ground reservoirs or elevated tanks, offset deficiencies in capacity of those portions of the supply works preceding them in the order of water movement. For towns with single stage pumping from deep or shallow wells, or from some other source of supply, the capacity consideration simply applies to the source of supply, the pumps and discharge lines. In such cases elevated storage likewise reduces the fire protection requirements of the supply works capacity.

ADEQUACY OF SUPPLY WORKS

The supply works may be adequate and still be unreliable. Under normal conditions adequate water can be furnished but should something happen to any part of the works which would cause a partial or total interruption of flow such as stopping of the supply, breakdown of pumps or power units, breaks in suction or discharge pipes, the need of frequent cleaning of reservoirs, repair of gate valves, interruption in power or fuel supply, etc., the water protection might be of little or no value for such a time as the interruption exists. The introduction of water storage, either elevated and independently supplying the distribution system or for suction supply to pumps, again works to advantage in that it offsets to a greater or less degree the need for duplication of the various parts of the supply works.

The pumps, motors, air compressors, electric generators and other separate and distinct power units together with storage should be of sufficient number and capacity to furnish the required quantity for the required period of time even if one or two units should become inoperative. Steam boilers and steam piping, electric transmission lines, gas or oil feed lines, electrical transformers, boiler feed pumps, etc., should be so duplicated that failure or interruption in any part would not prevent furnishing the required flow.

It is obvious that the carrying capacities of the supply and feeder

mains from the supply works to the various sections of the city or town should conform to the combined domestic and industrial demands and fire flow requirements of these sections. Water supply lines of adequate number and feeder lines properly spaced throughout the distribution system should be provided so that no single break or interruption would affect the service. Many existing weaknesses in supply and feeder line capacities and locations are due to growth and expansion of the municipality since the original system was installed. The original plans did not take into consideration the probable future growth and the need of making further extensions and supplying increased demands.

The distribution system in addition to the supply lines and feeders to various portions contains minor distributors having the function of carrying the water from the supply lines and arterial mains along the various streets furnishing supply for the services and fire hydrants. The distribution system should contain no mains smaller than 6 inches in diameter for hydrant supply. It should be remembered that a single 6-inch pipe will carry almost the same quantity of water as three 4-inch pipes. The minimum size of mains in the congested or high value district should in general be 8 inches. For the smallest towns with the mercantile buildings situated chiefly along one street, an 8-inch pipe on this street is adequate. In cases where the mercantile district constitutes only two or three blocks, a loop of 6-inch pipe encircling these blocks is sometimes sufficient.

It is assumed, however, that the supply lines from the pumping station and elevated storage leading to the mercantile district are adequate in size for the distance covered. At this point it is well to explain the advantages of having the elevated storage located on the opposite side of the mercantile district or on the opposite side of the town from the supply works or pumping station. One advantage is the greater water capacity available at the hydrants from a two-way feed through two separate supply lines, one from the supply works and one from the elevated storage. Another is the added reliability: in case the use of the supply line from the supply works is interrupted due to repairs or a break, the supply from the elevated storage is still available until exhausted. If the supply line from the elevated storage is out of service, the pumping supply from the supply works is still available.

The matter of gate valves is also considered. These should be of sufficient number and so located that no single case of breakage or

repair to the system or shut-off for other purposes will necessitate shutting off from use or service a length of pipe greater than 500 feet in the congested value district or greater than 800 feet in other sections. While planning a new gridiron system, the location of gate valves deserves study. All gate valves should be inspected or at least operated annually.

Much trouble is experienced with gate valves in some systems due to corrosion. This accumulation sometimes reaches the point where the valve cannot be operated and it becomes worthless as far as the system is concerned. Operating the valve at least once a year will tend to break the corrosion or at least retard its accumulation. Furthermore, under a systematic inspection of this kind the faulty valves are discovered when conditions are normal rather than during an emergency and sufficient time will be available to make the necessary repairs or replacement necessary. The larger or more important valves should receive attention more frequently. Furthermore, all valves in a system should be uniform in operation.

DISTRIBUTION OF HYDRANTS

The distribution of hydrants depends on the property to be protected and the fire flow required and also whether direct hydrant streams or fire department pumpers are used for fire fighting. The spacing of hydrants or the area that each hydrant should serve is given in table 2.

All hydrants should be inspected at least in the spring and fall of each year, after use at fires during cold weather and daily in the congested value district during periods of severe cold weather. Hydrants that do not drain properly should be pumped and inspected more frequently.

Hydrants should be so designed that if the hydrant barrel is broken off, the valve will remain closed. Street connections to the hydrants should be of 6-inch or larger pipe and should preferably be gated. Hydrants should have a barrel and valve of sufficient diameter and of such a design as to permit a quantity of 600 g.p.m. to flow with a friction loss of only 2½ lb. in the hydrant and a total loss of only 5 lb. between the street main and the hydrant outlet. Hydrants shall have at least two 2½-inch outlets and also have a large suction connection where fire department pumpers are used.

The pumping and power stations should be of fireproof construction and properly safeguarded against internal fire hazards and ex-

posure hazards. All power and pumping equipment should be of suitable design and capable of operating at full speed and full capacity. Electrical equipment and wiring should be properly and safely installed. If the electric current supply is from a single source or over a single line, the largest pumps should be provided with internal combustion engines for standby power. When power is dependent on coal, gas or oil, a minimum of five days fuel supply should be on hand at all times.

TABLE 2

Area Served by One Hydrant

APPROXIMATE POPULATION OF TOWN OR CITY	FIRE FLOW REQUIRED IN GAL. PER MIN.	IF FIRE DEPARTMENT PUMPERS ARE USED		IF DIRECT HYDRANT STREAMS ARE USED	
		Average Area per Hydrant in sq. ft.	Approximate Distance between Hydrants in feet*	Average Area per Hydrant in sq. ft.	Approximate Distance between Hydrants in feet*
1,000	1,000	120,000	345	100,000	315
2,000	1,500	115,000	338	90,000	300
4,000	2,000	110,000	330	85,000	290
6,000	2,500	105,000	323	78,000	280
10,000	3,000	100,000	315	70,000	265
17,000	4,000	90,000	300	55,000	235
28,000	5,000	85,000	290	40,000	200
40,000	6,000	80,000	282	40,000	200
60,000	7,000	70,000	265	40,000	200
80,000	8,000	60,000	245	40,000	200
100,000	9,000	55,000	235	40,000	200
125,000	10,000	48,000	220	40,000	200
200,000	12,000	40,000	200	40,000	200

* These are the approximate distances from the hydrant in question to the nearest 4 hydrants, each of which is located along one of the four branches of the two streets intersecting at this point. It is assumed that the city blocks are square and that the streets cross at right angles to each other.

Other items of importance from the standpoint of reliability and efficiency are: a good system for the appointment of employees; long tenure of office, preferably by means of civil service properly administered; complete records and plans of the physical structures and operation of the system; and sounding of fire alarms in the pumping plant which should have operators on duty twenty-four hours a day.

FIRE PROTECTION AND THE DISTRIBUTION SYSTEM

By George Tatnall

Fire protection is the governing factor in the design of the entire water system, both supply works and distribution system, in the smaller towns and cities, and is a very important factor even in the larger cities. The National Board of Fire Underwriters has set up, after careful study and research, a standard, based mainly on population, for the maximum amount of water required for fire flow in different sized municipalities which, we believe, is reasonable and is generally accepted in the water works field. This standard is the amount of water felt necessary to combat a fire which involves the major portion of a block and is not the maximum amount which can be effectively used on a fire of true conflagration proportions.

This is well borne out by the performance records during two recent conflagrations. In Fall River, Massachusetts, where a conflagration in 1928 involved all or parts of eight blocks in the central business district, in which our fire flow requirement was 10,000 gallons a minute, a conservative estimate of the rate of use or wastage of water was 13,000 gallons a minute. In the Chicago stockyards fire of 1934, which swept over an area of about 100 acres, our requirements for the entire section were 20,000 gallons a minute, whereas a conservative estimate of the rate of use at the height of the fire was 50,000 gallons a minute. The delivery of such an amount of water was a praiseworthy performance both by the water department and in the use of fire department pumping engines. This performance was not possible until the fire had extended beyond the limits of the stockyards proper. There the facilities planned and provided by the city for just that sort of a fire became available. Parallel 16- and 24-inch mains were provided, amply connected to larger feeders, and all small hydrants had been replaced about one year before. It was

---

A combination of papers presented before the Kentucky-Tennessee Section meeting, Louisville, Ky., March 22, 1938, and before the Illinois Section meeting, Decatur, Ill., April 5, 1938, by George Tatnall, Hydraulic Engineer, The National Board of Fire Underwriters, Chicago, Ill.

possible to operate two pumping engines efficiently from practically any hydrant outside the yards. This planned line of fire defense made it possible to cut off the fire before it spread into a compactly built, frame residential district to the east; if this section had become involved, it is hard to predict where the fire might have been stopped.

To establish the full demands on any water system during a fire, some amount must be added to the fire flow demand to care for the normal consumption which will continue to a greater or lesser extent throughout most fires. This might possibly be taken as the peak hour rate, for fires have an unfortunate way of occurring either in hot, dry weather when lawn sprinkling is at a maximum, or in severe, cold weather when many taps are left open to prevent freezing. Many a superintendent will testify that such peaks are tending to increase through uses for air-conditioning and greater civic pride in maintaining lawns, and they may reach rates of three or four times the average consumption throughout the year, or twice as much as the pumpage in any twenty-four hours. We are not so optimistic as to expect that fires of the magnitude we are considering will be extinguished in one or two hours. In considering storage, calculations must allow for a period of five or ten hours, depending on the size of the city. We also recognize the probability of decreasing peak demands during a fire through effective use of radio broadcasting or by other means, but we find it practically impossible to estimate the amount of such a reduction. With these features in mind, it is considered equitable to use the sum of the required fire flow and the maximum consumption in any twenty-four hour period as the total demand on any system.

WORK OF CHICAGO WATER PIPE EXTENSION BUREAU

About three and one-half years ago when the city of Chicago began extending the work of their Water Pipe Extension Bureau in making fire flow tests throughout the city, it was felt necessary to prepare standardized requirements for the more common types of districts prevailing in the city, and through the cooperation of J. B. Eddy, Engineer of the Bureau, and his district engineers, Messrs. Irwin and Edelstein, a rather complete tabulation has been drawn up and used.

Let us amplify the considerations which enter into the selection of a particular fire flow requirement at some street intersection. Type of construction, height, undivided fire area and fire prevention features of buildings, compactness and congestion of construction and

consideration of occupancies with special regard to combustibility of contents must all be kept in mind. It is evident that in some sections such as in industrial groups, these various features are so subject to change that no set rule could be drawn to apply; in others, such as in the usual residential districts, most factors will remain much the same.

The following requirements are all given in amounts of gallons per minute. The absolute minimum for scattered small buildings will be 500 gallons with a customary minimum of 750, the usual capacity of one fire department pumping engine. For districts with less than one-fourth the lots built, but still with some buildings grouped to form mutual exposures, the requirement will be 1,000 or 1,250 gallons. Next are considered districts which are approximately 25 per cent, 50 per cent and 75 per cent or more built up. For districts of bungalows or one and one-half story houses of brick, or so-called ordinary construction, the required amounts will be 1,000, 1,500 or 2,000 gallons respectively for the three degrees of congestion. For bungalows or one and one-half story houses of frame construction, 1,500, 2,000 or 2,500 gallons will be required. With two or two and one-half story brick houses again 1,500, 2,000 or 2,500 gallons are required, and for two or two and one-half story frame houses, 1,500, 2,500 or 3,000 gallons. The above figures may be tempered as much as 500 gallons when buildings are more widely separated on their lots. Frame is assumed to include brick-veneered, metal-clad or stuccoed construction as such building facings are of little value in resisting severe fires. Where construction is mixed brick and frame, the requirement for frame will generally apply as long as more than one-fourth the buildings are frame. The preceding covers in a general way all types of single dwellings, although there may be cases where rather well isolated large and palatial homes will require a minimum of 2,000 or even 2,500 gallons.

In considering various types of flat buildings, the yard spaces are usually reduced, and congestion increased; also, undivided areas tend to increase. For the usual two-story two-flat building of brick, 2,000, 2,500 or 3,500 gallons are needed, and if of frame, 2,500, 3,000 or 4,000 gallons, these still applying respectively when 25, 50 or 75 or more per cent is built up. For three-story buildings with one flat on each floor, the requirements will be 3,000, 3,500 or 4,000 gallons if of brick and 3,500, 4,000 or 4,500 gallons if of frame. In the six-flat, three-story brick building common in Chicago, 3,000, 3,500 or

4,000 gallons will apply unless basements are high and occupied to a considerable extent when 3,500, 4,000 or 4,500 gallons are needed. For large court type apartments three stories high, and with basements fairly well occupied, 3,500, 4,500 or 5,000 gallons are needed because of congestion and cross-exposures through unprotected windows, even though each group of six flats is cut off by a solid brick wall. The same figures will apply to buildings four full stories in height.

Beyond this in the scale of residential occupancies come the higher buildings of ordinary apartment, hotel apartment, hotel or club occupancy. Many of these will be of fireproof or semi-fireproof construction, but areas are often extensive, and while major openings such as stairs and elevators are usually enclosed from floor to floor, there are often minor shafts and pipe or cable ways which will permit the spread of fire vertically. Such buildings or groups are a problem for individual inspection and determination; some of the smaller may be governed by the surrounding non-fireproof construction, while in the larger, requirements of up to 7,500 gallons a minute have been set.

SCHOOLS AND CHURCHES PRESENT SPECIAL DEMANDS

Schools and churches are often the centers of higher demand in otherwise purely residential districts. Schools are usually somewhat isolated by the playgrounds adjacent, and therefore present more of an individual than a conflagration hazard. For one- or two-story schools ranging from small to large in size, the requirements will be from 2,500 to 5,000 gallons if of brick, and from 3,000 to 6,000 gallons if of frame. Where schools are three stories high, these amounts will be increased to from 3,000 to 6,000 gallons for brick, and from 3,500 to 7,000 gallons for frame. Churches of frame are usually comparatively small and will not require over 3,000 gallons a minute; those of brick ranging from small to large in size will require from 2,500 to 5,000 gallons, or more if closely grouped with schools or other allied buildings.

Minor mercantile districts often require individual inspection for determination of requirements; comparison of the construction with that of the principal mercantile district, where the requirement is known, is often of value. An occasional street-floor mercantile establishment hardly warrants an increase above requirements for the same sort of residential construction, but fairly continuous mer-

cantile establishments on the ground floor without areas much in excess of those in residential occupancies will require, roughly, 500 gallons more than the corresponding residential buildings.

In industrial groups of all sorts such as manufacturing plants, warehouses, lumber yards and oil storages, the numerous factors vary to such a great extent, particularly in the combustibility of contents or hazard of the particular process involved, that no set rule can be laid down, and inspection of each group is essential. Requirements all the way from 2,500 gallons in the smallest buildings worthy of designation as a manufacturing plant to the 12,000 gallons around a single block, and 8,000 gallons additional for a second fire in the Chicago stockyards, have been set.

There are numerous ways to improve fire protection with little or no cost by more effectively utilizing the facilities which are already provided. Complete records, properly arranged and in duplicate and easily accessible, both in the office and in the field, are conceded to be essential to an efficient water plant. They need not be ornate examples of draftsmanship, but they should be clear and legible, and should be kept up to the minute by placing penciled corrections on blueprints. The elaborateness of necessary records is governed to some extent by the size of the city or town, but this is more a matter of convenience in indexing and reference, and does not relieve even the smallest town from the duty of properly recording all details.

WATER DEPARTMENT SHOULD COOPERATE WITH FIRE CHIEF

The water and fire departments are working along the most closely related lines of endeavor, and there is little excuse for other than the very best of cooperation between the two departments. The fire chief should be furnished enough blueprints of the general system so that his men may become familiar, not only with hydrants, but with the general layout of mains which supply them. The superintendent or some responsible employee with proper knowledge of the system should be notified of all serious fires. He should respond to such fires with a gate key and other tools and with a detailed map or a gate valve record, so that he may shut off broken service connections or hydrants which have had to be abandoned, before the system is drained of much of the original capacity. There will be times when valuable suggestions can be made as to the location or relocation of pumping engines to avoid the weaker spots in the system; it should be clearly explained in advance that such suggestions are intended

only to be in a true cooperative spirit and in no way are they an attempt to tell the fire chief how to run his business. It is also desirable to discuss fully the results of any pressure or fire flow tests made, particularly after making main extensions or any other changes which alter conditions materially.

No distribution system can be efficiently utilized unless it is in first-class condition. To ascertain and maintain proper condition requires frequent and careful inspection. It is not common, except in smaller towns, to find much neglect of the inspection of hydrants. There are few things which will arouse greater criticism of a water department than to have a hydrant frozen or inoperative when its use is attempted at a fire. This is quite universally recognized, and the necessary expenditure for frequent inspection and required repairs of hydrants is accepted as an essential and proper operating cost. The principal difficulty in hydrant maintenance appears at present to be in failure to gain full cooperation from other city departments which use hydrants. If these departments can be trained in proper hydrant operation and taught to report, without exception, those used in cold weather, the water department can make a check inspection and avoid most of the frozen hydrants.

SMALL VALVES ALSO NEED INSPECTION

Much the reverse condition appears to be true in considering gate valves. It seems to be a fairly universally accepted attitude to put a gate valve in the ground and let it stay, trusting to luck that it will be available to do its required work when called upon. Quite often the valves of larger size, or, particularly those which are geared, are given proper inspection, but the smaller ones, which are in the great majority, are neglected. The constant plaint is, even when the value of inspections is admitted, that there is not any time to make them. In other words, the maintenance force is too small, or is spending too much time in the shop whittling, and it has not been admitted that the expense of valve inspections is a necessary part of the maintenance cost of the system. In our opinion, it definitely is and should be so considered. Without a doubt, many of you have stood by and "cussed" while your valve crew spooned out dirt or fished out stones from the valve box and then, perhaps, found the box had shifted away from the operating nut, or the stem had so "frozen" that it snapped when resort was had to putting pipe extensions onto the valve key handle. Such a procedure is embarrassing, with a small geyser spouting, washing out the streets, and pos-

sibly robbing fire engines of their supply while a fire licks its way onward. Imagine your consternation if the whole procedure should be repeated when you move the necessary two or three blocks down the street. As long as men are human, a valve will occasionally be left closed, and closed valves can be discovered only by accident, or by flow tests at frequent intervals or by inspection. The water works superintendent should not feel satisfied with inspecting just the larger valves; a closed 6-inch valve may be just as important if located close to the start of a fire, and even a 4-inch stream flowing free can flood a great many cellars.

Most of us have wondered why gate valves operating in more than one direction were ever invented, but they were, and as a consequence, many existing systems are handicapped by having some of each. This greatly increases the probability of men becoming confused and leaving some valves closed. Unless you are in the unfortunate predicament of having about half operating one way and half the other, the solution is to replace the stem and operating nut of the non-uniform minority. As a temporary expedient, in case you hesitate to dig up a newly-paved street, the inside of the valve box (not the cover which may be moved) can be painted red.

Most of the above outlined improvements in fire protection may be made at a minimum of expense; further improvements are apt to be more expensive, but many will not be excessively costly. Still with the thought of more effectively utilizing existing facilities, let us consider hydrant distribution and the related question of the size and efficiency of existing hydrants. There will usually be many gaps in the spacing of hydrants brought about by excessive economy in older installations or by the building up of areas formerly scattered or unbuilt. It certainly is more efficient to deliver water through pipes and hydrants than to stretch long lengths of 2½-inch fire hose with its high friction loss. Probably many of the hydrants in the most important and congested districts are the oldest on the entire system, and these are probably obsolete or in unreliable condition. It is expecting a good deal to anticipate reliable and fully efficient service from hydrants thirty, forty, or even sixty years old, but many seem to expect it, not only for the present, but for the same number of years into the future. Naturally, you cannot have a major operation and take them all out at once, but a definite program can be set up for a reasonable number of hydrant additions or replacements each year, starting in the most important districts.

Hydrant maintenance is also largely governed by inspection and

the usual routine for checking the various features is too well known to warrant repeating. There are one or two points which seem often to be missed in making hydrant inspections. The inspector may remove only the cap on the one most convenient outlet and make all the tests and observations on this. After a few years the other caps, particularly the one on the large engine connection, become so stiff as almost to defy removal. Such a condition results in the loss of valuable time when the fire department is attempting to go to work. As hydrants grow older, the threads on the outlets tend to wear or become battered. When this tendency is noticed, it might be well to prepare some simple gage showing the lower limit of tolerance and have this applied during the next hydrant inspection. Battered threads should, of course be rechased so that there will be little chance of crossing threads when a hose line is connected.

ARE SHUT-OFF SECTIONS TOO LONG?

All sorts of situations prevail with regard to gate valves. Take a map of your system and trace out in various colored pencils the length of main in each shut-off section. The extent of some of these will undoubtedly surprise you. Slip an appropriation for three or four valves into your budget each year and start cutting the most extensive sections in half; it will not be very many years before the worst are under control.

Opportunities can always be found in the distribution system piping to eliminate dead ends, to connect minor distributors to feeders, either directly or through sub-feeders, or to bolster gridiron by judicious cross-connections. By careful study, short ties can often be made very effective for improvement. The use of side connections rather than crosses in tying in new mains is an effective and economical method, and has the added advantage of later allowing uninterrupted service without temporary dead ends on either main when the other is shut down. If two valves are used on such side connections and hydrants taken off between, valve spacing can be increased on the main lines and still no hydrant will be entirely out of service when a line is shut down.

Improvements in the reliability of the supply works can many times be carried out without too great an expenditure. Duplication of short, single lines of piping or the installation of a few valves to prevent a break or the repair of another valve from totally interrupting supply may often be feasible after a careful study of existing layouts.

This may call for considerable ingenuity when the present arrangement is the result of many piecemeal extensions. Such a study should include all sorts of piping in the plant: low-lift suction and discharge, high-lift suction and discharge, steam lines, boiler feed lines, gas or oil lines to boilers, air lines from compressors, or electric supply lines. All of these have been factors at one time or another in the more or less serious interruption of supply from some plant.

Reliability of pump capacity is another and more expensive consideration, but a thought to be borne in mind when replacing or adding to pumps, and worth considering is: Do not be misled by the grandiose sound of a large capacity. You may proudly proclaim the purchase of a new ten-million gallon pump, but have you stopped to think what you will have left in service when the inevitable day comes when you tear it down to make repairs? How much more easily you would breathe then if there were two five-million gallon units side by side, or even two three's and a four. Such an arrangement can also help in delivering your night rate economically instead of having to throttle down a large unit and let the extra power go to waste.

A condition not occurring very often, but of importance in attaining improved protection when it does, is the efficient utilization of pumps. Pumping plants may have centrifugal pumps which have been used to work in series against fire pressure. As progress in modern practice continues and the use of fire pressure is abandoned, either through the introduction of elevated storage or otherwise, these pumps become useless for the purpose for which they were intended, and are still limited to the original capacity. Take, for example, a set of pumps designed to deliver capacity at 100 pounds fire pressure or 50 pounds each and each not able to deliver at over 55 pounds because of the cut-off of the characteristic curve. Elevated storage requiring a normal discharge pressure of 60 pounds is installed and the pumps must still operate in series and at their original capacity, but very inefficiently. By the simple and comparatively inexpensive expedient of changing pump impellers these pumps can be operated in parallel against the desired head and make available double the capacity for reserve; if motor sizes were skimped in the original installation they may not be sufficient, but ordinarily the margin of safety provided will be enough to take care of the added load.

Storage is always an aid in providing reliability; ground storage tends to lessen the reserve needed in well capacity and low-lift pumps,

clear-water storage for filters and elevated storage for high-lift pumps as well as all the previous stages of production. To offset the unreliability of such features entirely, storage must be large, but any amount is of some value.

Reliability is not much aided by reserve equipment unless that equipment is maintained in reasonably good condition, not necessarily 100 per cent in efficiency or quietness of operation, but at least in shape to deliver the rated capacity. The only way to insure this is to turn it over once a month and to start up and actually operate up to capacity at least every six months. This procedure has the added advantage, especially in the case of reserve steam equipment in a station normally electrically operated, of refreshing the details of operating procedure for the station crew which, without this, may easily lose the routine and confidence which are essential to proper operation. In this connection, a meeting of the entire operating force with a complete rehearsal of the procedure for operating all emergency lines or valves is often very worth while.

HYDRANT MARKING SCHEMES CRITICIZED

During the past several years the subject of some scheme for marking the capacity of hydrants has received considerable attention, and this association has proposed a color scheme for optional adoption by any city. In a constructive spirit, let us criticize this proposal and attempt to show that it will prove of but little value in its original intention of furnishing positive information to the fire department. Capacity ratings are to be established for flows on individual tests which, of course, is the only way in which they may be established without a vast and complicated amount of work in testing. This method would give dependable results in a town having only one fire department pumping engine, but in a city where three or four, ten or twelve or the well-known maximum of 100 engines (at the Chicago stockyards fire) may be put to work, it is quite undependable. We have demonstrated this to our own satisfaction hundreds of times in making our fire flow tests.

It was further definitely proved by a special series of tests made under the direction of Mr. Eddy of the Chicago Water Pipe Extension Bureau, in which 13 hydrants were opened successively around a central point. In these tests there were a number of instances where original capacities, flowing alone, of well over 1,000 gallons were reduced successively below 1,000 and even below 500 gallons.

This shows that a designated hydrant would have to be a chameleon and change color twice during the progress of a fire. In many cases a change in capacity class was indicated by the opening of only one or two additional hydrants, and this would be likely to be true in almost any city. Thus we feel that any attempt at general classification of hydrants should be discouraged. A special designation of hydrants set directly on or inside the valve on branches from 12-inch or larger mains is satisfactory; such hydrants can practically be guaranteed to give ample supply under any conditions.

To provide proper fire protection, the design of a distribution system must provide for the necessary fire flow in all portions. The requirement in the central business district is definitely established by population. In other districts the necessary amounts are governed by the fundamentals of building construction features, congestion and occupancy. The translation of these into actual amounts required can be made by rules which are necessarily hedged about with many qualifications and exceptions. When the requirements are established, it becomes a matter of calculation to provide them in the several parts of the city. In considering gridiron, the work of calculation, which is hard enough even under the latest methods, can be avoided by the use of past experience, which proves that 4-inch pipe, dead ends or long unsupported length of 6-inch pipe are entirely unsuitable. The principle of reliability should be followed by looping or duplicating feeders. Proper gate valve and hydrant spacing are essential to utilize the full value of the other provided facilities. The subject of maintenance can almost be dismissed with the one word, "inspection," together with the prompt carrying out of the repairs which such work discloses as necessary.

If these principles are faithfully held in mind and carried out, you may feel content that you have equipped your distribution system well for its battle against the demon, fire.

MAIN CLEANING IN NEW ROCHELLE

By Eugene T. Cranch

Early in the spring of 1928 The New Rochelle Water Company first started the cleaning of mains. At that time one of the oldest thoroughfares in the city of New Rochelle was taken over by the county and made a county highway. An 8-inch main had been laid in this road in 1886. Due to regrading, it became necessary to cut and relay some of this pipe. It was found to be so completely choked with tuberculation that it was considered advisable to clean the main before an expensive type of pavement was laid over it. A coefficient of 35 was found for this main before cleaning and 112 after cleaning. At this same time we also had about 10,000 feet of old 10-inch main cleaned. Since then mains have been cleaned at various times. Approximately 21 miles of main have been cleaned or about 8 per cent of our total mileage. We have cleaned 6,120 ft. of 4-inch mains, 16,540 ft. of 6-inch, 18,980 ft. of 8-inch, 31,700 ft. of 10-inch, 19,700 ft. of 12-inch, 6,370 ft. of 16-inch, and 12,000 ft. of 24-inch mains.

When starting a main cleaning job, we first locate all the services along the street to be cleaned; then we see that the curb boxes are up to grade and that the curb cocks are in working order. This usually is not difficult where we have only one main in the street, but in some cases we have two mains of different sizes laid almost side by side in the same street and it then takes quite a little research to determine from which main each service is tapped.

The street is opened and the main uncovered at the beginning and at the end of the section to be cleaned. The length of the piece of pipe to be removed at the beginning of the stretch is determined. A piece of pipe is cut from stock this same length and the cleaning

---

A paper presented at the New York Section meeting, Poughkeepsie, N. Y., September 23, 1938, by Eugene T. Cranch, Mgr., New Rochelle Water Co., New Rochelle, N. Y. Illustrations of a typical method of opening a main and the cleaning machine, and of the method of drawing the cleaning machine through a main are contributed by Clinton Inglee, M.E., National Water Main Cleaning Co., New York, N. Y.

machine inserted in this piece. The water in the main is then shut off and the curb cocks closed on each service. From this point on things are carried along as quickly as possible in order not to cause too great annoyance to the customers. All the customers have, of course, been notified in advance, and by this time many of them are usually out on the street watching operations. Two gangs are put to work cutting out the pipe at the beginning and end of the stretch.

FIG. 1. Typical method of cutting main to insert cleaning machine (right)

The piece of pipe with the cleaning machine is inserted at the beginning of the line and an eighth bend with a piece of pipe long enough to reach up to the surface of the ground is caulked, with yarn only, onto the main at the end of the section. Men with ear phones are then stationed at all intermediate valves on the stretch to be cleaned in order to determine when the cleaning machine passes the valve. Usually the machine shoots right through and soon pops out of the other end bringing with it tons of tubercles and dirt. A typical machine is seen in fig. 1.

If, however, the machine stops, then the fun begins. First we usually try "bumping" the machine. The inlet valve is closed and all the water possible allowed to drain off. Then the valve is opened quickly. Sometimes this has to be done two or three times. This method is often successful but if not then other means must be tried. If there is a hydrant near the inlet valve and another hydrant between the inlet valve and the spot where the cleaner is stuck, the fire department is called on for assistance. The inlet valve is closed and a pumper connected between the two hydrants. The pressure is then raised until the cleaning machine starts moving,—if it will. This method has also proven successful, but the facilities are not always there to put such a method into effect. If the machine still will not move, it then becomes necessary to dig it up. By means of the geophone it is usually easy to determine its exact location. Sometimes we have found it wedged in the pipe with a log of wood or a pick handle. It is sometimes caught on a defective lead joint, or stuck in a defective valve. If the type of fittings used in the line to be cleaned, is known in advance the machine can usually be so made up that it will pass an ordinary offset bend or eighth bend without difficulty. In such a case the machine is made a little shorter and the joints in it are left very flexible. But when the cleaner has been made up for a supposedly straight run of pipe and then runs into an offset made up of eighth bends we have found that it will stick.

Prior to 1906 all service taps installed were equipped with so-called eel traps which consisted of a cast bronze screen about one inch long projecting beyond the end of the tap into the main. Dozens of these eel traps came out of every main we cleaned. The cleaner has never stuck on them but has sheared them right off. The presence of these eel traps, however, probably accounted for some of the broken blades found on the machine when it came out of the pipe.

The foregoing applies to the so-called "shooting" of mains—where the cleaning machine is forced through by water pressure. In the case of 4-inch mains, very badly tuberculated 6-inch mains or even 8-inch mains when the available pressure is low, it becomes necessary to drag the machine through the main by means of a windlass and cable. In this case a special make-up piece which allows for the feeding of a light cable through it is inserted at the beginning of the section to be cleaned. The water is turned on and a light cable with a float at the end is washed through the main. After this has

come out at the end of the section, the water is turned off and the light cable is attached to the heavy cable on the windlass set up at the end of the stretch. The special make-up piece is removed and the light cable with the heavy cable attached is then drawn back to the beginning. The cleaning machine is attached to the heavy cable and drawn into the pipe; a permanent make-up piece is put in, the water turned on, and the machine slowly dragged through as shown in fig. 2. While this method of cleaning is as effective as "shooting," it is slow and tedious. When dragging, lengths of not over 500 feet are usually taken whereas in shooting, a thousand or

FIG. 2. Drawing cleaning machine through main by means of cable and winch

more feet of main may be cleaned at one time. Sometimes it is found impossible to wash the light cable through with a float and it then becomes necessary to push it through with sewer rods.

For a number of years we have experimented with the chemical control of water to prevent corrosion. We used to be troubled every winter with complaints of "red water" on dead ends. We then equipped our pumping plant for the application of soda ash. By raising the pH from 6.8 to about 8.0 we were successful in putting a stop to the red water complaints. As soda ash is a relatively expensive product to use and will not produce a coating to inhibit further corrosion, we used it only during the period when red water

complaints occurred, which would be two or three months during the middle of the winter.

As more and more main cleaning was done we felt that something should be done to retard the re-forming of tubercles in the cleaned mains. In the spring of 1936 we started the continuous treatment of our entire supply with hydrated lime, maintaining a pH of about 8.6. With only a few interruptions this treatment has been carried on continuously since then. In the course of this work it has been interesting to note that it takes about three days to built up the pH in some of the outlying parts of the distribution system. Also, when an interruption in treatment occurs it takes about three days for the pH to drop in these outlying sections. Except for these tests, I never would have thought that the movement of water in our distribution system was so slow.

We cleaned a number of mains in 1936 just as we were starting the lime treatment. We have had occasion to make Smith taps in some of these mains at intervals since then and from an examination of the tapping discs removed these mains would appear to be in excellent condition. However, we have been unable to find any evidence of a lime deposit on these discs, and they have shown evidence of the beginning of some tuberculation, though this is very slight.

On most of the mains cleaned we made flow tests before and after cleaning to determine the coefficient of friction. On two of the mains cleaned in 1936 we have run periodic tests to determine how fast the coefficient is dropping.

One of these mains is a 24-inch main which we tested by inserting a pitometer at the northern end to measure the rate of flow. In this test, pressures are recorded at three intermediate points south on the line from the pitometer. A rate of flow of 3 to 4 m.g.d. is maintained during the test.

The pitometer is read every half minute for a period of thirty minutes and the pressure gauges are read every half minute during the same interval. These readings are averaged and the average values used in computing the coefficient. In this method of testing it is, of course, also necessary to obtain accurate elevations at the test gauges, and to measure carefully the distance between them. The gauges are also calibrated on a dead-weight gauge tester both before and after they are used. As a check the coefficient of each section is calculated and then the coefficient for the whole length. These values have always been reasonably close together. Before

cleaning, this main was found to have a coefficient of 62 and after cleaning 116. In two years this coefficient has dropped to 75. Most of this drop occurred in the first year; the rate of drop for the second year has been very slight.

The other test is on an 8-inch main on Beechmont Drive, and the method of testing is illustrated in fig. 3. The valves are closed off as shown. By means of garden hose a manometer is connected up between hydrants #1 and #2. A three-inch test meter is then

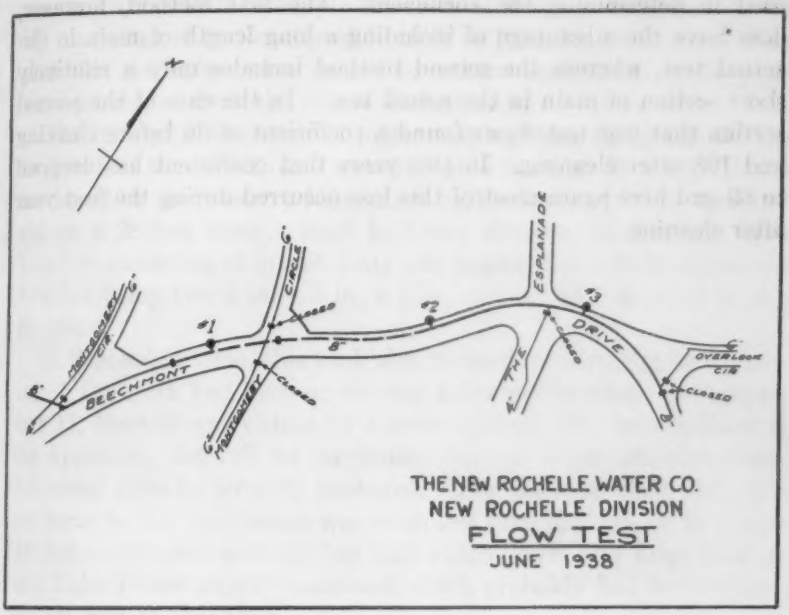


FIG. 3. Valves are closed and hydrants used in this test method

connected to hydrant #3 and tests are run at two different rates of flow. A fish trap is used before the test meter. When we first tested the mains after cleaning we found that there were a few loose tubercles which had not been flushed out of the main. After we had broken a couple of meter discs we decided it would be more economical to use a fish trap. Also, the fish trap provides a very convenient seat for the operator.

This method of testing was suggested by Burt Hodgman and I feel that it gives a more accurate determination of the friction loss than does the method first shown where pressure gauges are used.

In using the manometer it is also unnecessary to obtain any elevations. In the manometer we use mercury, carbon tetrachloride, bromoform, or a combination of carbon tetrachloride, bromoform and benzine, whichever will give us the greatest deflection within the range of the instrument. We also test each length at two different rates of flow. In this test the flow meter is read every minute and the manometer every half minute for a ten minute interval. The results of these readings are averaged, and the average values are used in determining the coefficient. The first method, however, does have the advantage of including a long length of main in the actual test, whereas the second method includes only a relatively short section of main in the actual test. In the case of the second section that was tested, we found a coefficient of 36 before cleaning and 108 after cleaning. In two years that coefficient has dropped to 69 and here again most of this loss occurred during the first year after cleaning.

AN UNUSUAL STANDPIPE FAILURE

By Charles H. Bliven

A riveted steel standpipe 25 feet in diameter and 100 feet high was erected in 1892 to supply the town of Berkley, Virginia. Berkley was annexed to the city of Norfolk in 1906, but its water system and this standpipe were owned by others until 1923, when these were purchased from the city of Portsmouth.

The standpipe was made of plates varying from $\frac{3}{16}$ inch at the top to $\frac{5}{8}$ inch at the bottom and was estimated to weigh 59 tons. It was anchored to the masonry foundation by ten bolts $1\frac{3}{4}$ in. in diameter set on a 28-foot circle. Each bolt was attached to the tank by a bracket consisting of gusset plate and angles; the bottom leg of the bracket being two 3 in. x 3 in. x $\frac{3}{8}$ in. angles and 7 in. x 12 in. x $\frac{1}{2}$ in. plate.

In September 1936, this tank was drained for scraping and painting. The work had been under way a few weeks when, on September 17, Norfolk was visited by a severe storm. We were warned of its approach, but felt no particular concern about the standpipe, believing it to be securely anchored. The storm of 1933 had done no harm to this tank which was often less than half full, or to a tank 10 feet in diameter and 120 feet high which serves as a surge tank on our Lake Prince supply main and which probably had little water, if any, in it at that time.

The Weather Bureau records showed a maximum wind velocity of 68 miles an hour, with 60 miles indicated at Virginia Beach; and at midnight we were advised that probably the worst was over. But at 7:00 A.M. on September 18, one of our employees living in Berkley telephoned to me that the standpipe was rocking back and forth and that he feared for its safety. At first I did not believe him, but when he convinced me that he was in earnest, I ordered him to get men and tools and make an attempt to fill the tank. The men returned to the tank, but did not attempt to fill it with water—it

A paper presented at the Virginia Section meeting, Richmond, Va., November 5, 1937, by Charles H. Bliven, Division of Water, Norfolk, Va.

would have been useless to do so since the movement of the standpipe on its base had no doubt broken the inlet pipe attached to the bottom. The men asserted that the tank raised as much as three feet on one side before it finally fell at about 8:30 A.M. The top of the tank did considerable damage to an adjacent building but caused no injury to any people.

If we assume that the wind velocity was 70 miles per hour, there would be a pressure of 15 lb. per sq. ft. Assuming that this pressure

RIVETED STEEL STANDPIPE
Reported wind velocity of 68 miles per hour caused this overturn

was on the projected area of the standpipe, and that the center of pressure was at a point at two-thirds of the height, the overturning moment figures 2,500,000 ft.lb. Further, if we assume that the tank was stiff enough to tilt on one edge, which it actually did, the resisting moment due to the weight of the tank was 118,700 lb. times $12\frac{1}{2}$ feet = 1,484,000 ft.lb. The excess overturning moment would have produced only moderate stresses in the brackets and anchor bolts, yet the standpipe actually tore loose from its anchorage and toppled over.

We believe this failure was due to two things. First, we believe

that the wind velocity at this particular point was much in excess of 70 miles. Second, the men on the scene observed that the upper part of the standpipe collapsed and folded together as would a roll of soft paper were it pushed together in the hand. We had never before known of such an occurrence. With the upper part of the tank in that shape, it probably acted much like a sail, and there is no telling what overturning force was in this manner exerted by the wind. At any rate, it was sufficient to tear the anchors apart. The anchor bolts were uninjured, and the bottom legs of the horizontal angles and plates remained attached to them; the upstanding legs of the horizontal angles tore loose and went with the tank, still attached to the gusset plates.

Substantial stiffening rings around the upper portions of the standpipe would probably have prevented the collapse.

NEW EMERGENCY REPAIR TRUCK FOR MINNEAPOLIS

By J. Arthur Jensen

One of the important contrivances for water works maintenance is the emergency repair truck. While such a truck is not strictly a new idea, some of the essential tools in the array of devices are of recent origin. In the Minneapolis Department there has been recently completed a truck of this kind. A special truck body was secured with the cab over the motor. A van type body was built to order, having a rear platform hang-over.

The space in this truck is arranged and occupied with the following equipment and tools: Inside on the right is a work bench 12 feet long and equipped with a drill press, drill bits, vise, electric grinder and a small lathe. Beneath this at the front is a map compartment; at the center are three drawers with files, scrapers, hammers, wrenches, sand paper and small tools; and at the rear is a compartment for a blower which can be used for driving gas from manholes or ventilating while working in tunnels. At the front there is a seat box with fire extinguisher, battery compartment, set of socket wrenches, clean rags and pails.

At the left is a 3,000 watt alternating current power plant for operating much of the equipment and lighting set. The center on the left has three large drawers containing a welding torch and hose, large wrenches and pipe tongs, hack saw blades, miscellaneous tools and taps and dies. This space also accommodates buffer and grinding wheels and packing pullers.

A rear seat box contains rubber boots and rain coats. There is also a compartment for a 2½-inch centrifugal gasoline pump in this space. Above on the left is a 9-foot shelf for a first aid kit, saws and hatchets and other supplies.

On the outside, doors open to various compartments (as may be

---

A paper presented at the Minnesota Section meeting, Minneapolis, Minn., September 29, 1938, by J. Arthur Jensen, Supervisor, Water Works Department, Minneapolis, Minn.

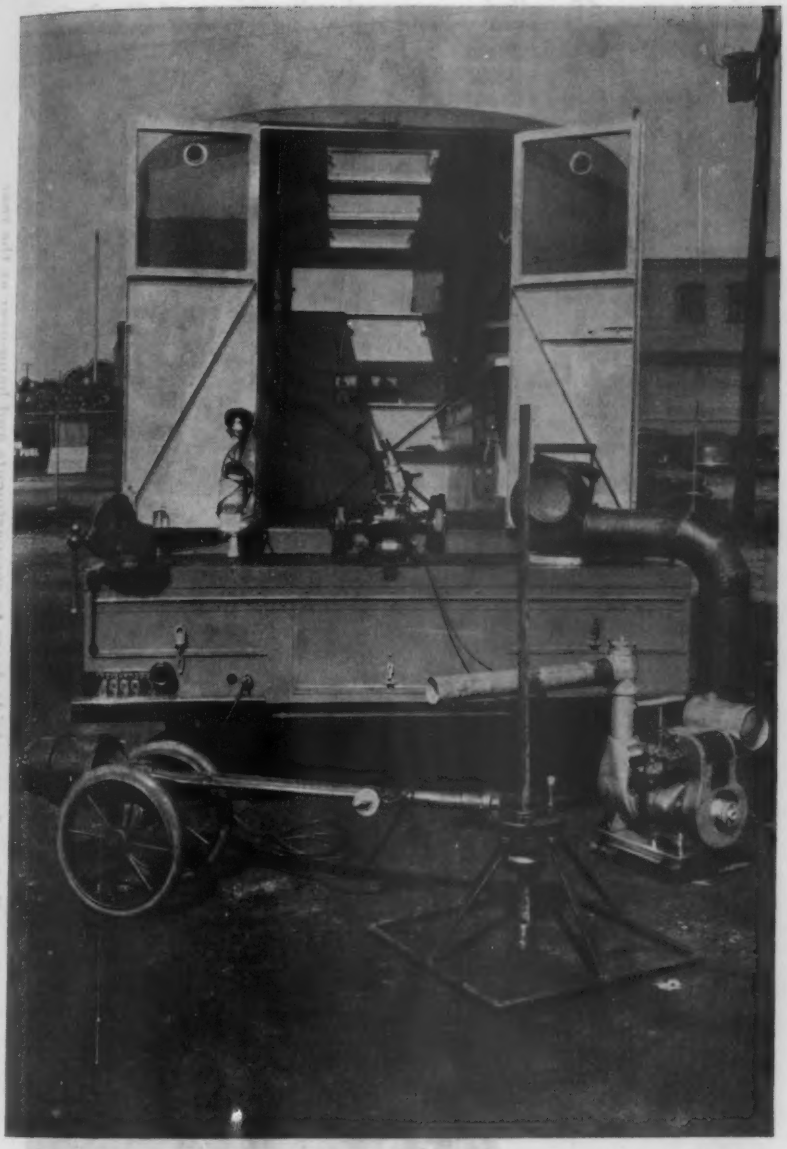


FIG. 1. General layout of new emergency repair truck for the maintenance department at Minneaplis.

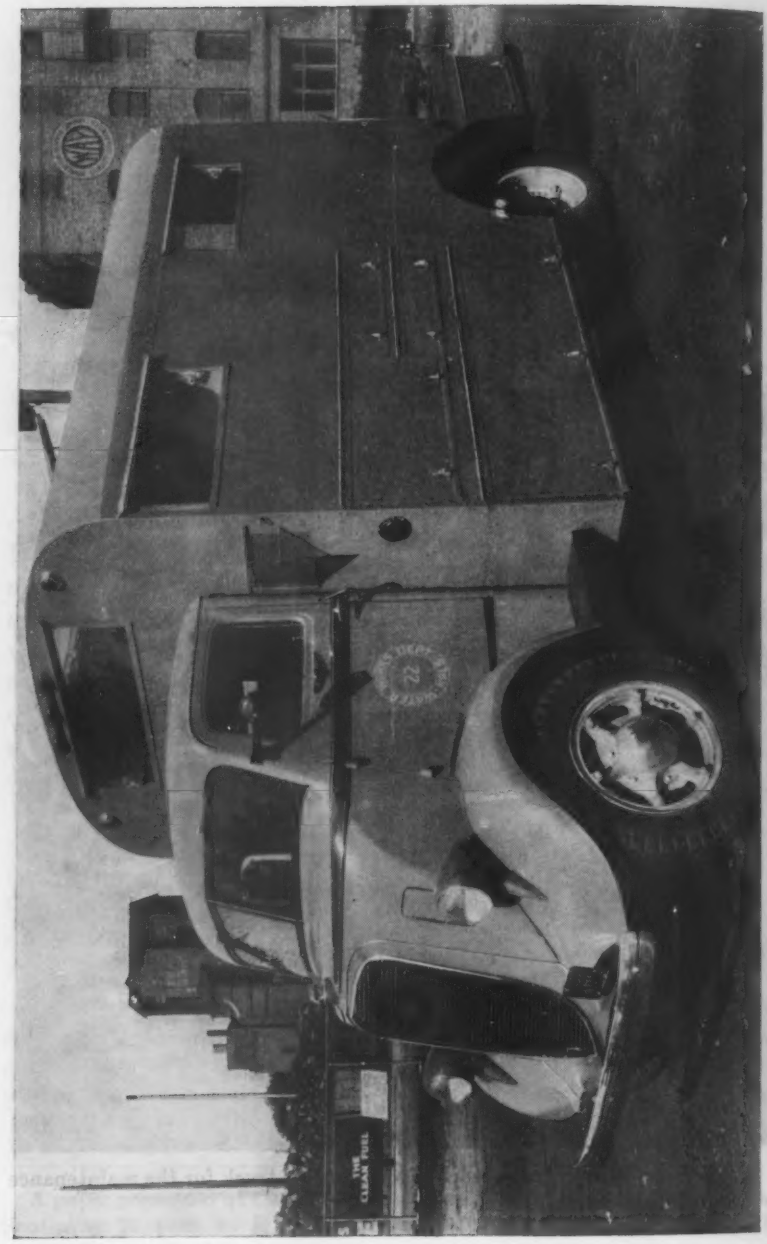


FIG. 2. Over-all view shows outside doors to compartments and hang-over at the rear

seen in fig. 2) for packing, hard grease, and oils. There are ten bins for bolts and nuts, a bin for a large thawing blow torch, gasoline and kerosene cans and lanterns. A suction hose compartment 12 feet long is provided so that the hose lengths may be carried straight. There are two large compartments for heavy tools such as bars, long and short shovels and picks. There is space for shaft pullers, electric drill, a portable grinder and gear pullers, truck jacks, chains, tire tools, acetylene and oxygen tanks. There is a cupboard for the gate operating machine and ventilator for the power plant.

At the rear are kept extension cords and weather proof light cords and spot light. A compartment is also provided for large tools, hammers, danger signals, blow torch, wedges, blocking and tool pails. The rear hang-over is used for a field work bench, with two swivel vises and an electric grinder. The roof of the cab has a long glass panel for lighting the interior working space and bench.

One of the most valuable provisions is the motor-driven gate operating device. This is provided with a slip clutch which prevents undue strain on gate stems. When the clutch slips the operator knows that the gate is either beginning to seat or the stem movement is meeting with undue resistance and strain. From this point the remaining closure is accomplished by hand in order to judge better the application of force. This outfit is essential for general repair work and emergencies but it is particularly valuable in the maintenance of gate valves and hydrants.

FIG. 2. Over-all view shows outside doors to compartments and hang-over at the rear

NEW UNIFORM SYSTEMS OF ACCOUNTS

By A. L. Adams

Among the reasons for issuing new uniform systems of accounts for water utilities, effective as of January 1, 1938, was to give recognition to what may be termed evolutionary progress in standards of regulation of utility accounting. Since the issue of earlier accounting systems, it has become more and more widely accepted that utility accounts should reflect the original costs of plant at the time the property units were first used for utility service. In addition, statutes have been enacted requiring utilities to account for property losses according to carefully prepared depreciation estimates instead of irregular appropriations under the so-called retirement reserve accounting plan. Naturally, after using the earlier prescribed instructions for ten years or more, defects of varying importance, as well as possibilities for improvement, were noted.

Indirectly, the issue of new accounting instructions for water utilities was caused by increased jurisdiction of accounts by federal commissions. The Federal Power Commission adopted a new classification of accounts for larger electric utilities. To avoid undue burden and conflict in respect to electric utilities subject to both state and federal regulation, the National Association of Railroad and Utilities Commissioners drafted a new uniform system for Classes A and B electric utilities which conformed closely with the Federal Power Commission instructions. Since water utilities frequently are operated in conjunction with electric utilities, it was obviously desirable that the prescribed accounts for both types of utilities, particularly as to balance sheet and income accounts, should be the same or as nearly alike as practicable.

Furthermore, because utilities grow, it was desirable to revise instructions for Classes C and D utilities in conformity with principles and general arrangement of accounts prescribed for Classes A and B utilities. Thus, partly as a result of instructions from federal author-

---

A paper presented at the Wisconsin Section meeting at Milwaukee, Wis., Oct. 11, 1938, by A. L. Adams, C.P.A., Public Service Com. of Wisconsin.

ities for large electric utilities, it became necessary for small municipal water utilities wholly within Wisconsin to revise their accounts not only to meet local needs, but, in part, to fit in better with standards for all utilities, large and small, throughout the nation.

CHANGES IN BALANCE SHEET ACCOUNTS

A great many of the new balance sheet accounts for Classes A and B utilities represent subdivisions for purposes of more accurate description and classification. For examples, utility plant is broken up into six accounts; capital stock and long-term debt is subdivided between twelve instead of seven accounts; and the old account, Contributions for Extensions, has been superseded by the two accounts: (1) Customers' Advances for Construction, to cover items which may be refundable in total or in part, and (2) Contributions in Aid of Construction, for nonrefundable items.

Instructions for the new account, Capital Paid in by Municipality, and the account, Advances from Municipality, should correct some errors in classification which were fairly common under the old system. The account, Capital Paid in by Municipality, supersedes the old account, City Equity, and should cover amounts paid in for permanent use in the utility enterprise. As indicated by its grouping in the chart of accounts, this account is closely analogous to capital stock, and by this analogy and specific instructions should not be reduced except under extraordinary circumstances, such as liquidation of the utility.

Any amounts paid in by the municipality which the utility is expected to repay at some future date should be credited to the advances account. This account should include general obligation bonds issued for utility purposes on which the municipality as a whole, rather than the utility, is primarily liable. For a municipal utility, the only obligations to be included in the account, Bonds, are those issued under the provisions of Section 66.06 of the Wisconsin Statutes, which are secured by statutory lien against utility property and are not payable from general funds raised by taxation.

CHANGES IN UTILITY PLANT ACCOUNT

The uniform system in effect prior to January 1, 1938 included accounts for undistributed engineering and superintendence, legal expenses, injuries and damages, tax, and interest during construction. These accounts were intentionally omitted from the new

system because of unsatisfactory experience in the use of the old accounts. Being undistributed, the amounts of these overheads applicable to units of property were not readily identified with the direct costs to which they applied. Too many cases were noted where direct costs were eliminated by retirement entries without deducting anything from the overhead expense accounts. If followed consistently, an addition to property or a retirement required an entry in one account for direct costs and entries in as many as six undistributed overhead expense accounts for the same item.

The use of undistributed overhead expense accounts probably originated with the practices of valuation engineers in reporting direct costs of reproduction separately from overheads added on the basis of flat percentages. Many of the water utilities which now carry accounts for undistributed overheads probably will find that the amounts were recorded according to some appraisal in early years. To distribute these amounts in compliance with the new uniform system, these overheads should be distributed pro rata to the direct costs recorded on the basis of the same valuation. In such cases it is fairly safe to predict that the utility accountants will find that some of the direct costs originally recorded according to appraisal have since been eliminated by retirement entries. If that be true, the pro rata share of the overheads applicable to the plant removed should be charged against the depreciation reserve.

PLANT COSTS AND ACQUISITION ADJUSTMENTS

According to instructions in effect prior to January 1, 1938, utility plant should be recorded at "actual cost at time of its acquisition." The new instructions go one step further in requiring utility plant in service to be recorded "at the original cost incurred by the person who first devoted the property to utility service" and segregation of utility plant acquisition adjustments applicable to operating units or systems acquired by purchase, merger, etc.

This change in definition of cost of property became necessary because of inconsistencies and abuses in connection with consolidations, mergers, and other transfers of ownership. For a company which has owned the same property from the time of first organization up to the present, actual costs according to the old instructions and original costs according to the new instructions should be the same. If, however, the properties had been sold to another company,

the latter owner would have been permitted to record the net consideration paid to the prior owners, which might have been much greater than original cost. In many actual cases book costs recorded by acquiring companies consisted of original costs plus substantial allowances for changes in price level, plus allowances for intangible values, and less allowances for depreciation, and these net figures were distributed to costs of tangible property.

The purpose of the new instructions is to retain the integrity of original costs of utility plant, together with amounts of related reserves, without distortion by changes in ownership. The actual cost to the present owner may be readily determined from accounts kept according to the new instructions by adding the purchase adjustment to net cost. In cases of water utilities which have changed ownership, the purchase adjustment frequently is substantial in amount, due largely to the differences between original costs of mains laid during periods of low prices prior to 1914 and reproduction costs during post-war years.

These differences in price levels may properly be considered in rate matters to whatever extent changes in price levels are pertinent in rate matters. However, the amount of price level changes varies from time to time as prices fluctuate. To achieve consistency it seems desirable that the utility accounts should reflect original costs which are fixed amounts, rather than any estimates of reproduction costs, which will probably vary from time to time. Such estimates can be made when, as, and if necessary.

COMMON UTILITY PLANT ACCOUNTS

For a great number of water utilities which are operated in conjunction with electric utilities the use of common utility plant accounts as provided in the new accounting instructions will be helpful in clearing up considerable confusion. Such joint electric and water utilities frequently use the same office building and equipment, transportation equipment, and the power plant land and structures.

Heretofore some utilities have split the cost of individual items, such as an adding machine, a truck, or an office building, on some arbitrary percentage basis, or charged the entire costs of different items to one utility department or the other, according to predominant use. The former procedure of splitting items is objectionable because it makes it difficult to ascertain the entire cost of an item

when retired, and the latter procedure is objectionable because one department is apt to be charged more than its fair share of the total cost of the property.

By using common utility plant and depreciation reserve accounts, costs of particular items are clearly set forth in one place. The utility, however, should be prepared to allocate the plant costs, reserves, and expenses between departments on bases consistent with actual use. These bases should be determined from careful study of operating conditions.

DEPRECIATION VS. RETIREMENT ACCOUNTING

Instructions for the old retirement reserve account stated that "the object of the account is that the burden of such (retirement) losses may be as nearly as is practicable equalized from year to year, but with due regard for the amounts of earnings available for the purpose in each year." These instructions left the door wide open for manipulation of earnings by managements interested in selling securities at prices above, or buying securities below, fair prices based on intrinsic worth. Moreover, variation of provisions for property losses according to earnings ignores the fact that all tangible property (other than land) is on the "inevitable march to the scrap heap"—that property continues to wear out in good times and bad, irrespective of any earnings whatsoever.

The term "investment" has been so often associated with speculative purchases made in the hope of resale at higher prices that its use in describing utility plant in service is definitely misleading. Utility property is not purchased for resale at a profit but for use, and service value at time of purchase eventually becomes reduced to scrap value.

Utility property is not so much like an investment as it is prepaid expense, such as a pile of coal or an unexpired insurance policy, the entire cost of which at some time must be charged to operating expenses.

The coal pile may be consumed in a month or two. The amount paid for an insurance policy may cover one, three, or five years; a truck may be used for seven years, a boiler for twenty years, a pump for thirty years, and a water main for more than one hundred years. Expenditures for all these items represent parts of the cost of service. Depreciation expenses consist of apportionments of

one type of service costs applicable to comparatively long periods of time. Because the lengths of periods of use are not known at the time of making the expenditures, estimates must be used for apportionments. Obviously, all available information and good judgment should be used in making the estimates.

SUBDIVISION OF DEPRECIATION RESERVE AND EXPENSES

Most water utilities in the past have used composite rates of depreciation applicable to the total book cost of utility plant. Theoretically, any such composite rate should represent a weighted average of several different rates for classes of property with varying service lives. Probably in a great number of cases no such study was made and the composite rate used was based on little more than a guess. The new instructions for Classes A and B utilities require utilities to do what they supposedly did before, that is, estimate the service lives and depreciation rates applicable to separate classes of plant. The instructions further require these utilities to keep subsidiary records showing accumulated depreciation provisions and retirement losses in respect to the several classes of plant, whereby the depreciation rates may be revised according to the actual experience of the utility.

The annual amount of depreciation for any class of property, as computed on a straight-line basis, represents 100 per cent of cost, less the net salvage per cent of cost, divided by the number of years of service life. The first factor involved in the computation, cost, is known or determinable; the second factor, net salvage percentage, which has a comparatively small effect on the final result, is an unknown which must be estimated; the third factor, service life, consists of the sum of known or determinable years of service realized to date plus the unknown number of additional years of use expected, which must be estimated.

Since this last factor is the variable which has the greatest effect on the final result, the estimate should be based on careful study and judgment as to pertinent local conditions rather than mere generalities. The actual years of service will differ according to the quality and type of equipment, severity of usage, and replacement before physically worn out with equipment of greater efficiency or capacity.

The factors involved in estimating depreciation rates may be illustrated by consideration of the circumstances in respect to a particular power plant building. This structure cost about $10,000

in 1901. Its brick and masonry were of good quality. Ten years ago, when steam-driven pumps were replaced by electric motor-driven pumps, a modern heating plant was installed, which, together with other improvements, cost $4,000. The present composite age of this building ($10,000 of it 37 years old, $4,000 of it 10 years old) is 30 years in even figures.

This building has been well maintained and apparently can be used as many more years as it has served already. There is ample ground space for an additional wing so it would not be necessary to abandon the present plant site if additional facilities should be required in the future. However, some of the pumps now in use probably will be replaced in about 15 years, and the heating plant probably will be replaced at the same time. Assuming 50 years of additional service life for the main walls, foundations, etc., and 15 years for the internal improvements, gives a weighted average of 40 years. This 40 years of estimated future service added to the 30 realized to date gives a total of 70 years. Assuming that proceeds from salvage will be practically equal to removal costs, the proper annual rate of depreciation to be applied to the cost of this building would be 1/70 or 1.43 per cent.

ALLOCATION OF DEPRECIATION RESERVE

The purpose of the requirement for subdivision of the depreciation reserve account according to primary accounts for utility plant is to accumulate data as to actual losses realized in comparison with estimated provisions for such losses, in order that the latter may be adjusted in conformity with the utility's experience. If practicable, the subdivision of the reserve as of January 1, 1938 should be made on the basis of retroactive analyses of depreciation reserve transactions prior to that date. If the information available in respect to transactions for prior years is incomplete or unreliable, the subdivisions may be made without detailed studies other than those necessary for computations of annual depreciation rates, according to steps outline as follows:

1. Multiply annual class rates of depreciation (as certified by the Commission) by the numbers of years of service realized to January 1, 1938.
2. Apply these percentages to the book costs of the several classes of plant to obtain estimated depreciation accumulations for trial purposes.

3. Apportion the actual amount of the depreciation reserve shown by books as of January 1, 1938 pro rata to the trial estimates.

This procedure provides a rough check on the reasonableness of the class rates and is easy to apply. If estimates of realized service life at January 1, 1938 are fairly accurate, the results from this method are equitable for the intended purpose.

CONCLUSION

One of the instructions which should be followed more frequently, particularly during these periods soon after the issue of the new systems, is the one stating that utilities shall submit questions of doubtful interpretation to the Commission for consideration and decision. To do so is directly to the advantage of the utility, not only to forestall criticism for errors, but to obtain uniformity and accuracy in accounts for its own use.

The entire matter of keeping accurate records is one of mutual interest to the management of utilities for purposes of efficient administration and to the Public Service Commission for regulation. For this reason, the Commission will be glad to assist utilities at any time in solution of their particular accounting problems.

RESEARCH—AN ESSENTIAL TOOL

By L. W. Wallace

Research, the tool of the intelligent workman, is not something elusive and fantastic to be used only within the mystic atmosphere of the cloister. It is an organized, diligent investigation to discover facts which may be applied with equal facility and assurance to the solution of any problem in any realm of human activity. It is a tangible, ready tool, the wise use of which begets results whose value exceeds the expenditures in time, effort and money.

In a large degree, research is an attitude of mind, that attitude which prompts one to be eternally asking the question "Why?"—that attitude which does not permit the closing of the mind, that attitude which leads to ascertaining what people are doing in other lines of work and adapting that which is adaptable to one's own work, that attitude which warns against the folly of complacency and satisfaction with things as they are, that attitude which expresses itself in the phrase "What is not yet, may be."

FUNDAMENTAL RESEARCH IS ONE PHASE

The research pattern may be divided into three parts, namely, fundamental, creative and applied, or expressed differently, fundamental, producer and consumer research.

In fundamental research the primary objective is to discover the basic principles underlying the universe and the circumstances of life. The investigator is primarily interested in broadening intellectual horizons. The profit motive is not a factor. While the results of fundamental research may not add immediately to the financial assets of the world, yet they are indispensable to the progress of mankind. They form the basis and the foundation on which depends the intelligent utilization of the resources of nature and the broader well-being of mankind. We may say then, that the objective of those engaged in fundamental research is to discover some of

---

A paper presented at the New Orleans convention, April 26, 1938, by L. W. Wallace, Director of Eng. and Research, Crane Co., Chicago, Ill.

the secrets of nature for the sole satisfaction of knowing and the gratification incident to advancing the sum total of human knowledge.

CREATIVE RESEARCH IS PRODUCER RESEARCH

The word creative means "having the power or quality of creation: originative, productive." The primary objective of creative research, therefore, is to discover, invent or produce new materials, new processes, new equipment, or to find new uses for existing materials. This type of research is characterized by the work of some chemists, physicists, engineers and others whose work is largely based upon the principles discovered by those engaged in fundamental research. The results of creative research express themselves in new types of materials or substances, as Dow metal, Bakelite, Duco, radio tubes, a variety of equipment and a myriad of other things. Therefore, the financial incentive plays an important rôle.

Creative research may be designated as producers research, through which means producers are enabled to manufacture and sell new and improved commodities. Notwithstanding the financial incentive phase of this type of research, there often flows from it a large measure of information which does directly contribute to an understanding of the basic principles underlying the universe and to the broadening of intellectual horizons.

Producer or creative research, as organized and conducted today, has come into being almost entirely since the beginning of the twentieth century. Actually, the major expansion in this important phase of industrial development has taken place during the past two decades. At the present time, to name a truly progressive industry is to name one which conducts organized, diligent investigations to discover facts.

The National Research Council has announced that there are over 1,600 industrial research laboratories in the United States. The objectives of these laboratories are: over one-third, improving the product and reducing production costs; twenty-five per cent, primarily interested in developing new fields of application for their products; and fifteen per cent, emphasis on the discovery of by-products and the development of new materials.

The great advance in creative research has arisen from the conviction that neither a given company nor a given industry can safely coast along on past accomplishments. It is now realized that to survive each must constantly seek new markets; each must con-

tinually improve its products; each must create new designs, new materials, and new products; each must find new uses for existing products; and each must mold its policies in keeping with the demands of the age. These necessary, progressive activities come within the scope of creative or producers research.

APPLIED RESEARCH IS CONCERNED WITH PRACTICAL PROBLEMS

The word applied means "to put to practical use; also sometimes, concerned with concrete problems rather than with fundamental principles." Therefore the primary objective of applied research is to solve concrete operating problems by using the knowledge, materials, equipment and processes made available by fundamental and creative research. In other words, the primary objective is to determine what basic principles, new materials, equipment and processes may be applied to the solution of concrete problems in order that increased efficiency and economy may be realized in daily operations. It is a process through which the consumer or purchaser intelligently selects the materials, processes and equipment best adaptable to his purposes and needs.

It is frequently difficult to draw a line between creative and applied research or between their equivalents, producer and consumer research, because of the close interlocking interests of the producer and consumer. Indeed, each frequently finds himself in a dual situation—both a producer and consumer. He creates and he consumes. Oftentimes much advantage can be realized by cooperative research, when the producer and consumer jointly engage in research.

In another realm there is much to be gained by pooling research facilities, personnel and financial resources. This applies particularly to an entire industry. In many cases an entire industry could make greater progress through joint rather than individual effort. This may be confined to the non-competitive phases within the industry or to the competitive phases presented by other industries. It is not unusual to find that the major competition is not within, but is without an industry. Probably the major competition of the lumber manufacturer is not another lumber manufacturer but a steel, cement or synthetic materials manufacturer. In such cases, it may be highly intelligent to forget internal competition, and jointly, through research, meet the outside competition.

The three types of research discussed form a trilogy, to use a literary term. Between the three there is an unbroken two-way

traffic. There is passed down from one to the other indispensable fuel which each independently uses as required. Likewise there is passed up from one to the other information as to what are the requirements of the human race. This interchange of information serves as a spur to workers, in each type of research, to strive to bring forth additional knowledge, materials and equipment. Each type is necessary for the advancement of the intellectual, social, spiritual and economic status of the human race.

As you know, the company with which I am associated is a producer of valves, fittings, heating and plumbing equipment. As a producer it engages in creative research. Reference will be made to a few of the research problems now receiving attention as examples of this type of research.

The more important and pressing problems confronting the valve and fittings industry are metallurgical. They were not so when the pressures and temperatures at which fluids were used were moderate. Then it was a comparatively simple matter to design and manufacture valves, fittings, pipes and pressure vessels.

Today the demands of industry with respect to pressures and temperatures present an entirely different picture from a metallurgical point of view. Present day exacting requirements place upon the designer and fabricator a responsibility the like of which was never experienced before. The exacting requirements are easily stated but often are very difficult to meet.

It may be a comparatively simple task to design a pressure vessel to withstand almost any pressure at moderate temperatures, but the problem is vastly complicated by high temperatures. For instance, point 30 carbon steel may be expected to have an ultimate tensile strength of 75,000 lb. per sq. in. from ordinary temperatures up to approximately 600 degrees F. As the temperature is increased above 600 degrees F., the tensile strength drops rapidly, being only approximately 23,000 lb. per sq. in. at 1200 degrees F. Nothing short of the result of thorough metallurgical research will serve the purpose of development and design under such circumstances.

The design and manufacture of valves to withstand high pressures and temperatures involves many other questions than simply discovering a satisfactory body material. The best combined efforts of metallurgist, designer and fabricator are challenged in the attempt to find a seating material which, at high temperatures, will withstand the effects of erosion and corrosion; which will not seize or "gall";

and which can be mechanically built into the valve in a satisfactory manner.

To most people a bath tub, a lavatory, a water closet, or a kitchen sink, is each a simple device. They would be surprised to know of the technical problems involved in their design and manufacture. They have to withstand extremes of water conditions, temperatures, cleansing agents and various types of abuse. Their design and production involve metallurgy, ceramics, the production and application of enamel and many other highly technical questions. No rule of thumb treatment will meet the requirements of this day and age with respect to such items. Only the best creative research will answer.

It was the recognition of such definite and difficult technical problems coupled with the desire to serve better its trade that motivated my company, a few years ago, in making research one of its major functions. In keeping with this definite policy it has established the Division of Engineering and Research, the sole function of which is to conduct those lines of development and research work which will insure improvements in its existing products and which will expedite the addition of new products to its line of manufacture and sales.

This Division maintains a large staff composed of engineers, chemists, physicists, metallurgists, ceramists, and other types of scientists. It also has a comprehensive series of laboratories completely equipped to handle almost every kind of technical problem arising in connection with the manufacture of the company's products. These laboratories are so equipped that investigations may be made in such realms as metallography, spectrography, radiography, photoelasticity, petrography, ceramics, physics, physical chemistry, creep of metals, and the wear and seizure of metals. There are also facilities for the testing of plumbing products, heating and ventilating equipment, pumps, and high-pressure valves, fittings, fabricated pipe, and welded constructions. A thermal laboratory provides means whereby boilers, radiators, and other equipment for domestic heating are thoroughly tested as to their efficiency and performance.

To assure the selection of good risks each research project should be planned and budgeted in detail before starting actual work. If this be done there will be fewer failures and more successes. Furthermore, by planning, budgeting and scheduling, the criticism of research on the grounds of indefiniteness as to cost and time of completion may be largely removed.

After all, research should be considered as a type of production. Carefully organized and diligently pursued industrial research has paid its way and will continue so to do. As an agency for developing new and better products it has proven itself a valuable tool for both producer and consumer. Industrial research will become universally recognized as an essential function of industry.

Discussion by A. A. POTTER.* I shall call to your attention two activities which should be considered by your Association.

1. The American Water Works Association should give greater attention to research, which is the "fountain of youth" for water companies as it is for electric utilities and manufacturing industries. The leading industries of this country are spending from one to four per cent of their gross income for research. Progress means constant change. I am confident that the organizations represented by the American Water Works Association can improve their position with reference to earnings, public confidence and quality of product, if as individual companies, or through the Association, they will devote some funds to research. You may be able to substitute the certain for the uncertain by devoting some funds for research. Research for the industry you represent is like insurance for you personally. Your future may be more secure if you are constantly on the lookout for new knowledge, through research, to keep your practice ahead of your immediate needs.

Even during the worst years of the depression (1932–1934) large sums were being expended for research at Purdue University by industries, railroads, and electric and gas utilities. These have been augmented since 1935 by large contributions for engineering research in the fields of glass technology, housing and high pressure steam. During the present year, Purdue University is receiving $50,000 for basic research in road building alone.

2. The companies represented by this Association should give greater attention to the selection of personnel with an engineering background. Last year 110 different companies and utilities had their representatives at Purdue University to interview members of our senior engineering class. I am informed that no water companies had such employment representatives. It may be advantageous for your companies to study the employment recruiting methods of electric utilities.

* Dean of Engineering, Purdue University, Lafayette, Ind.

FILTER MATERIALS, FILTER RUNS AND WATER QUALITY

By H. E. Hudson, Jr.

Choice of filter materials has been of vital concern to water works men since the days of the first filter. At one time coke, sponge, gravel, or charcoal were widely used. Today sand is the most prevalent filter material, although some anthracite coal and a little magnetite are being used. The water works profession has long been divided in its choice of filter sands, some preferring rounded grains and others angular crushed grains. So far as is known no one has published a detailed evaluation of the various materials, hence most engineers' preferences are largely based on fancy, not facts.

To a large degree, rule-of-thumb methods have determined our choice, although during the past ten years a great deal of information has been published on the choice of filter materials. A large part of this information has been directed toward proving that coarser sand may be used, or that other materials are equal to sand in filtering ability. The objective in almost all these studies has been to secure longer filter runs rather than purer water.

Dangerously coupled with the tendency toward somewhat indiscriminate use of materials which give longer filter runs, is an old custom of engineers—the practice of designing filter units for average conditions. It is admittedly foolhardy to select pumping equipment adequate for the average pumpage, without regard to the maximum conditions. How then, is it wise to select filters for average conditions without careful regard for the maximum conditions that they may meet?

Present practice in designing filters too often gives undue weight to economy of operation and frequently sadly neglects the fundamental reason for water filtration: to safeguard the public health. In recent years water-borne epidemics have been reported from some

A paper presented at the Illinois Section meeting, Decatur, Ill., April 6, 1938, by H. E. Hudson, Jr., Jr. San. Eng., Experimental Filtration Plant, Chicago, Ill.

cities equipped with modern filtration plants. Concern naturally arises as to the possibility that under certain conditions the treatment process failed in its prime function of safeguarding the public health. If so, why?

The Chicago Experimental Filtration Plant has given a large amount of study to filtering materials. This paper includes results from a large number of extended tests, chiefly on glass tube filters, and it gives information on some of the vital factors which govern the choice of filter materials. Following a brief outline of the published experimental data on filter materials, the results of the Chicago studies are given.

RÉSUMÉ OF LITERATURE

A search of the literature has been made and the bibliography appended to this paper lists most of the recent publications. The writer believes these papers will lead the reader to the following conclusions:

1. Filtration takes place within as well as at the top of the filter layer (4, 15, 19, 20).
2. Filter runs vary as the 2.15 power of the effective size (1, 16).
3. The Baylis method of effective size determination gives excellent correlation of filter runs with filter material size (1, 4, 16).
4. Filter runs vary with the reciprocal of the rate of filtration to the 1.5 power (16, 17).
5. Filter runs vary with a power of the filter material porosity of approximately 3 (2, 3, 4).
6. Filter runs on anthracite coal filters are longer than those on sand filters, and the effluent quality is equal to or better than that from sand filters (5 to 13).
7. The value of glass tube filters as guides to plant operation is questionable (14).

On the basis of the data to be presented in this paper the writer would modify conclusion No. 5 and challenge the validity of conclusions 6 and 7.

Unfortunately, most of the comparisons of filtering materials hitherto published have been predicated on rather limited data collected during periods of normal flocculation. This greatly diminishes the value of the information given. We need to know how

TABLE 1

Effect of Settling on Filter Performance

	PLANT FILTERS			GLASS TUBE FILTERS		
	6	7	10	10(AX-2)	11(BX-2)	12(CX-2)
Hours Settling, Applied Water	7.2	3.4	0	7.2	3.4	0
Condition of Filter Layer	Fair	Fair	Poor	Fair	Fair	Fair
Turbidity of Applied Water						
Sept., 1933	2.2	3.5	9.8	Same as Plant Filters		
Oct	3.2	4.7	15.1			
Nov	6.1	8.7	21.8			
Dec	6.3	9.3	18.3			
Jan., 1934	3.8	5.3	13.5			
Mar	2.7	4.5	19.5			
Apr	2.8	4.1	11.3			
Hours Filter Runs to 8-Foot Loss of Head						
Sept., 1933	37.2	30.9	7.8	24.3	19.4	8.5
Oct	31.9	26.3	7.2	20.6	18.4	8.5
Nov	49.9	42.6	11.7	39.4	35.2	12.1
Dec	56.0	46.0	17.0	45.9	42.3	14.6
Jan., 1934	51.8	42.1	16.3	36.4	31.7	13.9
Mar	64.6	56.7	15.8	40.8	34.4	16.3
Apr	51.6	44.9	14.0	27.4	23.4	10.5
Average	49.0	41.4	12.8	33.6	29.3	12.1
Turbidity of Filtered Water						
Sept., 1933	0.12	0.08	0.48	0.18	0.24	0.29
Oct	0.13	0.13	0.26	0.08	0.11	0.14
Nov	0.11	0.08	0.42	0.08	0.07	0.07
Dec	0.08	0.05	0.34	0.05	0.05	0.07
Jan., 1934	0.05	0.02	0.34	0.00	0.00	0.01
Mar	0.08	0.00	0.39	0.02	0.01	0.14
Apr	0.16	0.00	0.43	0.00	0.02	0.01
Average	0.10	0.05	0.38	0.06	0.07	0.10

All filters operated at 2 gal. per min./sq.ft.
All filters contained similar Muscatine sand.

different filters compare in performance under severe and extreme conditions (18). To secure such data it is usually necessary to operate filters over long periods of time or to establish for a particular series of experiments the unusual operating conditions sought. Data obtained during times of weak coagulation are of special value in determining the filter performance under extreme conditions. Almost nothing has been reported on such tests.

CHICAGO EXPERIMENTS

The experiments described below were made in the Experimental Plant on the equipment, and under procedures described fully elsewhere (2, 4, 12); hence no space is here devoted to detailed description of these experiments. The data herein have not been previously published. They are used to examine some of the conclusions to which the literature led. In all cases below, the results were obtained by continuous routine operation of the filters and by daily turbidity measurements on the filtered waters, using the Baylis turbidimeter which is accurate to 0.1 p.p.m. Filter runs were terminated at an 8-foot loss of head. Sand layers were between 23 and 25 inches deep except where otherwise noted.

It is assumed that the turbidity-removing ability of a filter is proportional to the power of the filter to remove bacteria. It is obvious that a filter which permits passage of large quantities of turbidity is likely to fail in its bacterial removal function.

PLANT-SIZE FILTERS COMPARED WITH GLASS TUBE UNITS

Most of these experiments were performed on 2-inch glass tube filters, so it was desirable to determine first whether results from glass tube units were comparable to those from larger filters. In table 1 are given monthly averages of filter runs and effluent turbidities from three experimental units having 10 sq. ft. of filter area and from three glass tube filters about 2 inches in diameter. This experiment was made in order to determine the effect of settling on filter performance. In comparing filter runs on settled water, it was found that those from glass tube filters were about 30 per cent shorter than plant filter runs. The results on unsettled water were almost identical.

It is thought probable that the differences between plant and glass tube filter runs may be explained by the fact that the plant filters were not kept in the best condition during the experiment, while

the glass tube filters were kept quite clean. Furthermore, in the plant filters there was observed some pulling away from the side walls which did not occur in the case of glass tube units. Hence the results were closer than might have been expected. In either case, turbidities of filtered water seemed to compare very closely, except

TABLE 2

Operating Results for Various Sized Filters

FILTER	NO. 2	NO. 5	NO. 6	5(Q-4)
Sq.ft. Area	100.0	10.0	10.0	0.0180
Gal. per min./Sq.ft	2.0	3.0	2.0	2.0
Filter Material	Muscatine sand	Muscatine sand and coarse coal	Muscatine sand	Muscatine sand
Sand Depth, inches	24.0	24.0	24.0	24.0
Effective Size of Sand, mm.	0.503	0.522	0.537	0.485
Condition of Bed	Excellent	Excellent	Poor	Excellent
Filter Runs to 8-Foot Loss of Head				
January, 1936	16.8	29.0	20.6	11.7
February	16.2	26.1	19.0	10.6
March	13.3	27.1	16.7	11.4
April	8.6	19.4	11.8	5.4
May	3.1	14.8	7.6	2.1
Average	11.6	23.5	15.1	8.2
P.P.M. Effluent Turbidity				
January, 1936	0.00	0.28	0.09	0.03
February	0.02	0.24	0.20	0.05
March	0.03	0.20	0.07	0.10
April	0.09	0.16	0.43	0.09
May	0.07	0.17	0.14	0.14
Average	0.04	0.21	0.19	0.08

for the plant filter treating unsettled water. This filter pulled away from the side walls considerably.

The results from four filters are given in table 2. One unit had an area of 100 sq. ft., two had 10 sq. ft., and one was a 2-inch glass tube unit. Plant filter 5 had a 2-inch layer of coarse coal placed on top of the sand. It was operated at a somewhat higher rate of fil-

tration than any of the other three. The other three units had similar sand in them, yet the filter runs were not identical. The data on turbidity of the filtered water are inconclusive, but the results from the glass tube filter fall in between the results from the two comparable larger units. Table 2 shows that the use of coarse coal on top of the sand increases filter runs appreciably. Filter No. 6 was not in good condition during these tests. The sand pulled away from the side wall, hence it gave longer filter runs and higher effluent turbidities than the largest unit or the glass tube.

TABLE 3

Turbidity of Filter Effluents

	PLANT FILTER NO. 4	GLASS TUBES	
		9(J-3)	13(DX-1)
Effective Size, mm. (Top 6 inches)	0.520	0.632	0.489
Porosity	44.0	50.9	45.1
Depth of Bed, inches	24.0	21.0	23.0
Rate of Filtration, Gal. per min./sq.ft.	2.0	2.0	2.0
Filtered Water Turbidity			
November, 1931	0.01	0.18	0.17
December	0.03	0.05	0.06
January, 1932	0.01	0.05	0.04
February	0.03	0.05	0.06
March	0.06	0.09	0.07
April	0.05	0.11	0.08
May	0.04	0.03	0.03
June	0.15	0.12	0.11
Average	0.05	0.08	0.08

In table 3 are given data from one filter having 10 sq. ft. of area, and from two glass tube filters. These data indicate a close parallelism between the large unit and the small glass tube units, where filtered water quality is concerned.

In all the tests listed in tables 1, 2, and 3, care was exercised to obtain comparable data. The data given have been carefully examined to make certain that the same influences acted on all the filters in equal measure. The only exception is in the case of filter 5, table 2, where a non-comparable rate of filtration was used. The data given in these first three tables were collected during periods of

TABLE 4

Filter Performance with Various Filtering Materials

Filter	5(Q-4)	11(BX-3)	12(CX-3)	13(DX-3)	14(EX-4)	15(FX-5)	16(GX-5)	17(HX-3)	19(D-8)	19(Z-4)	20(JX-4)
Material	Muscatine Sand	Ottawa Sand	Red Wing Sand	Muscatine Sand	Cape Cod Sand	Menantico Sand	Menantico Sand	Anthrafilt	Crushed Quartz	Crushed Glass	Crushed Iron Ore
Effective Size, mm	0.485	0.527	0.463	0.536	0.477	0.403	0.527	0.432	0.470	0.550	0.338
Per Cent Porosity	44.0	42.7	42.1	43.3	44.7	46.0	47.4	53.6	52.7	54.7	55.7
Hours Filter Runs to 8-Foot Loss of Head											
April, 1935	32.3	37.9	25.5	27.2	24.7	28.6	44.0	45.8	54.7	95.7	35.6
May	18.1	20.8	16.2	14.0	13.4	15.4	22.1	24.2	28.6	53.6	17.6
June	6.9	8.4	5.1	5.5	4.9	5.0	8.1	8.7	11.0	20.1	6.7
July	8.6	10.2	6.0	7.0	6.8	6.8	10.8	10.5	12.5	23.6	8.8
Aug	9.9	12.2	6.6	8.9	8.9	8.1	14.6	14.0	18.1	29.7	10.7
Sept	7.4	8.0	4.5	5.8	5.8	5.3	9.6	9.4	12.2	20.9	7.0
Oct	7.8	8.4	3.6	6.1	6.6	6.2	9.9	9.1	11.8	22.0	9.2
Nov	7.7	8.6	4.1	6.1	6.4	6.6	10.2	10.7	14.0	24.8	9.4
Dec	10.3	11.5	6.0	9.2	10.3	8.9	13.9	15.3	18.5	30.3	12.8
Jan., 1936	11.7	13.4	6.5	10.1	11.6	9.0	15.1	17.2	20.6	32.4	13.8
Feb	10.6	11.7	6.0	8.8	9.5	7.9	12.4	15.8	16.4	26.6	12.1
Mar	11.4	12.4	7.3	9.9	10.6	8.4	13.3	14.6	15.3	27.8	10.9
Apr	5.4	6.5	2.9	4.8	4.9	3.8	6.8	9.4	8.3	17.8	6.4
May	2.1	2.6	1.4	1.9	1.9	2.2	2.7	3.2	3.8	8.9	2.6
Average	10.72	12.30	7.26	8.96	9.02	8.73	13.82	14.85	17.55	31.00	11.68
Corrected, 0.5 mm. size	11.4	11.1	8.7	7.8	10.0	13.8	12.4	20.2	20.0	25.4	27.0
Turbidity of Filtered Water											
April, 1935		0.01	0.00	0.00	0.01	0.00	0.02	0.02	0.02	0.02	0.00
May		0.04	0.03	0.01	0.01	0.02	0.01	0.07	0.01	0.01	0.02
April, 1936		0.02	0.00	0.00	0.00	0.00	0.01	0.07	0.08	0.04	
May		0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	
June		0.02	0.04	0.03	0.04	0.02	0.00	0.00	0.03	0.04	
Average		0.018	0.016	0.008	0.012	0.010	0.010	0.032	0.028	0.022	

Layers were 24" deep. Filtration rate was 2 gal. per min./sq.ft.

reasonably good coagulation and do not represent a comparison of filters under extreme conditions. Therefore, the conclusions drawn from these tests are definite only for fairly normal conditions of coagulation.

The results in tables 1, 2, and 3 indicate that the quality of filtered water from glass tube filters is comparable to that from larger filters. Glass tube filters appeared to produce slightly better water than the larger units, probably because care was taken to keep them in excellent condition. In general, filter runs on glass tube units in these tests were shorter than those from large units. Possibly this was because the side wall effect was not as great in the case of glass tube units.

FILTER MATERIAL POROSITY RELATED TO FILTER RUNS

Table 4 gives the lengths of filter runs for a 14-month period on ten glass tube filters containing filter materials of various porosities. Daily turbidity measurements were made continuously during only five months of this period, consequently no conclusion can be drawn as to which produced the best water. Had complete turbidity measurements been made, no conclusion could be drawn because during this period no floc passed through even the coarser filters and almost any filter could have produced good water. The turbidity which passed through these filters during the test period was of a colloidal nature, present because of occasional incomplete coagulation.

Table 4 also lists the effective size and porosity of the filter material in each tube. In this table the averages of the filter runs have been corrected by Baylis' relation (1) to the length of filter run which would have occurred had the effective size of each material been 0.5 mm. These corrected figures have been plotted in fig. 1, and the curve which they define indicates quite clearly that the filter runs vary with the porosity to the 3.8 power instead of the 3.0 power. The results scatter somewhat from the curve, but in no case is the curve in error more than 25 per cent. More extensive experiments may indicate some modification of the exponent of the porosity, but this is the best information we have available at this time.

These data indicate a correlation between filter material porosity and filter runs which exists without regard for the type of material. Materials having equal porosities and effective sizes produced almost identical filter runs, regardless of whether the materials were crushed quartz, crushed glass, anthracite, or magnetite.

While complete turbidity measurements were not made on the filters listed in table 4, daily tests were made over a seven-month period on six glass tube filters containing various filtering materials. During this period covered by table 5, there were wide differences in the lengths of filter runs obtained from the various units. Although the effective size and porosity could not accurately be determined on all of the materials, the figures in the table indicate considerable variation in size. One might expect this to cause variation in the effluent quality. These results, together with the partial data in

TABLE 5

Effluent Turbidities from Various Filtering Materials

FILTER NUMBER	DX-2	EX-3	FX-4	HX-3	D-7	Z-4
Material	Muscatine Sand	Crushed Quartz	Min-char	Anthra-cite	Crushed Iron Ore	Crushed Glass
Effective Size	0.489	0.475	0.509	0.457	0.359	0.547
Porosity	45.1	52.7	56*	55.1	55.0	54.7
Depth of Layer, inches	24.0	24.0	24.0	24.0	24.0	24.0
March, 1934	0.03	0.00	0.01	0.00	0.01	0.03
May	0.09	0.10	0.04	0.07	0.09	0.14
June	0.12	0.12	0.13	0.11	0.11	0.12
July	0.12	0.12	0.11	0.14	0.11	0.14
Aug.	0.11	0.09	0.11	0.08	0.10	0.07
Sept.	0.21	0.20	0.19	0.27	0.20	0.20
Oct.	0.14	0.15	0.05	0.11	0.13	0.08
Average	0.12	0.11	0.09	0.11	0.11	0.11

* Estimate.

All units operated at 2 gal. per min./sq.ft.

table 4, seem to indicate that the porosity of the filter material has little or no effect on the quality of the filtered water.

Why were the effluents from these units almost identical? The only explanation which we can advance is that the water they received contained about 0.1 p.p.m. of uncoagulated turbidity which would have passed through units even finer in effective size than these. Comparison of the filtering ability of filtering materials during a period when the coagulation is strong, as it was in this case, is of no value in measuring the limits of filter ability, because even very coarse

sand would in all likelihood produce an effluent of quality equal to that produced by normal sand under such conditions. There was turbidity in the effluents above listed because the alum dosage was intentionally controlled to leave a very slight colloidal turbidity.

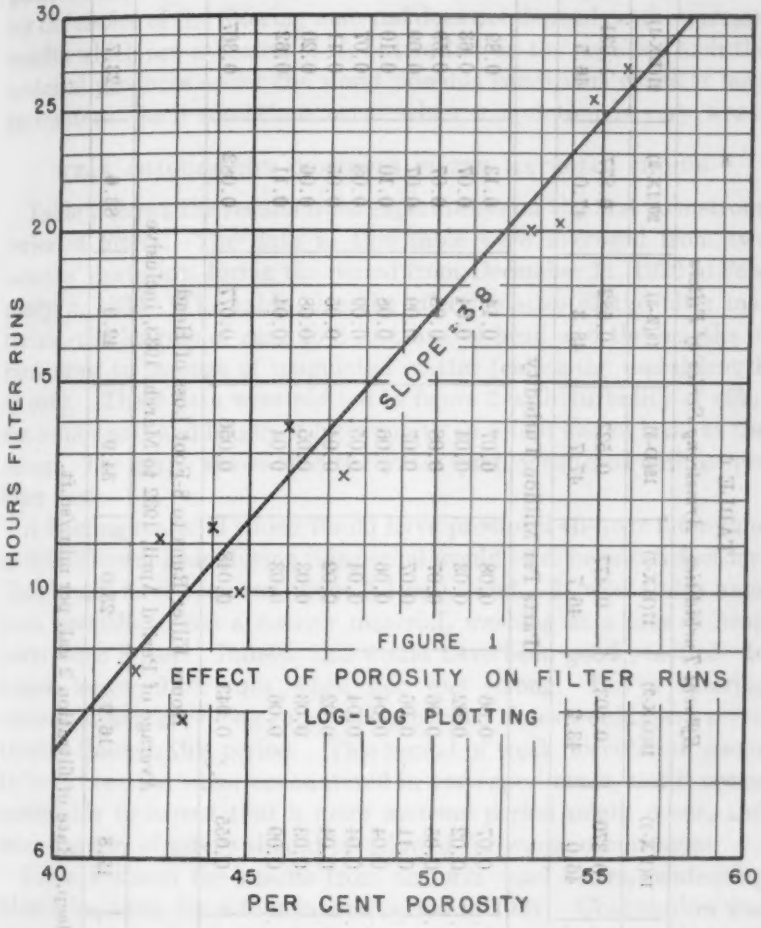


FIGURE 1
EFFECT OF POROSITY ON FILTER RUNS
LOG-LOG PLOTTING

Table 6 shows the data on effluent quality from eight filters of the second Armstrong series which were operated under the sponsorship of the American Society of Civil Engineers Committee on Filtering Materials in 1932. During the nine-month period shown, filter runs varied widely, and they varied in accordance with the Baylis law, yet the turbidity measurements indicated very little difference

TABLE 6

Effluent Turbidities—Armstrong Series of Filters

Filter	15(FX-2)	16(GX-2)	17(HX-2)	18(D-5)	19(Z-3)	20(JX-2)	21(LX-1)	22(MX-1)
Effective Size, mm...	0.370	0.403	0.477	0.527	0.582	0.877	1.031	1.62
Per Cent Porosity...	46.0	43.2	46.7	47.7	48.3	47.0	46.5	46.7
				Parts Per Million Turbidity				
April, 1932.....	0.07	0.06	0.08	0.07	0.14	0.13	0.89	1.58
May.....	0.02	0.02	0.03	0.04	0.04	0.07	0.63	1.18
June.....	0.05	0.06	0.07	0.08	0.08	0.07	0.59	0.80
July.....	0.11	0.06	0.07	0.07	0.09	0.07	0.09	0.14
Aug.....	0.04	0.04	0.06	0.06	0.08	0.10	0.10	0.16
Sept.....	0.04	0.04	0.04	0.05	0.09	0.08	0.07	0.20
Oct.....	0.04	0.02	0.02	0.04	0.05	0.05	0.11	0.63
Nov.....	0.03	0.03	0.03	0.05	0.08	0.06	0.20	0.34
Dec.....	0.09	0.06	0.03	0.04	0.04	0.11	0.62	0.61
Average.....	0.055	0.043	0.048	0.056	0.077	0.082	0.367	0.627
				Hours Filter Runs to 8-Foot Loss of Head				
				Average of Period April, 1932 to March, 1933, inclusive				
Hr. Run.....	12.8	16.9	25.0	34.9	42.0	83.6	123.7	348.7

Beds were 24 inches deep. Rate of filtration 2 gal. per min./sq.ft.

between the six finer sands. Even the average of the results from the filter containing 0.877 mm. sand was of good quality.

If we were to choose a filtering material on the basis of these nine-month tests, we would select a material having an effective size greater than 0.8 mm. This would obviously be an unwise selection, for the choice of the filtering material does not depend on the average results which are expected of it, but rather on the results which the material produces under the worst possible conditions which it may encounter. Such conditions occur when coagulation is very weak.

WEAK COAGULATION CONTROLS FILTER MATERIAL CHOICE

Table 7 shows the results from experiments on the first Armstrong series of filters. The data in this table were averaged from two months' operation during the period from December 11, 1929 to February 5, 1930. The table lists the effective sizes of the filter materials, the lengths of runs to 8-foot loss of head and the lengths of runs prior to passage of coagulated matter (called the useful length of run). These data were plotted in figure 2 with turbidity of effluent as one axis and length of filter run to an 8-foot loss of head as the other. The graph shows that the water quality suffered with longer filter runs.

A filtering material which would have produced 40-hour filter runs to 8-foot loss of head during this period would have been satisfactory. This would have required about 0.4 mm. sand. It would also have been possible to use a coarser material, washing at a loss of head lower than 8 feet. Indeed, this would have been good practice—to insure longer filter runs when floc was strong. But a filtering material which gave long runs during normal times would have given trouble through this period. This period of weak flocculation seems to have been the worst encountered in our experiments, but it seems reasonable to expect that a more extreme period might occur, and some margin of safety should be allowed for worse occurrences.

Table 8 shows the results from uniform sand filters, containing Muscatine sand, for a four-month period in 1931. Coagulation was not as weak during this period as it was in the early 1930 period, yet a similar relation between length of filter run and effluent quality is shown by a plotting of these data in fig. 2. From these figures and curves it seems apparent that any advantage gained by having longer filter runs may be offset during period of weak flocculation by passage of weakly coagulated turbidity. It is interesting to note in

table 7 that the filters giving long runs to 8-foot loss of head gave the shortest useful filter runs, and the filters giving the shortest runs to 8-foot loss of head gave the longest useful filter runs. While the data from the two plant filters did not check precisely with the data from the glass tubes, it plotted reasonably close to the curve, indicating fairly comparable results.

In table 3 are given data for two glass tube filters, one containing sand, the other water-worn anthracite. The anthracite produced an effluent equal to that of the sand. Coagulation was strong during

TABLE 7

Operating Data, First Armstrong Series of Filters

Average of Period—Dec. 11, 1929 to Feb. 5, 1930

FILTER	EFFECTIVE SIZE, MM.	LAYER DEPTH, INCHES	LENGTH OF RUN TO 8 FT. LOSS OF HEAD	USEFUL LENGTH OF FILTER RUN IN HOURS	AVERAGE EFFLUENT TURBIDITY
1(M-1)	.515	24	76.7	14.1	0.58
2(N-1)	.307	24	17.4	27.4	0.00
3(O-1)	.568	24	92.0	15.0	1.87
4(P-1)	.400	30	37.4	45.5	0.06
5(Q-1)	.422	24	46.8	41.4	0.12
6(R-1)	.430	18	45.8	23.3	0.66
7(S-1)	.490	24	57.2	16.1	0.88
8(J-3)	.632	24	72.0	6.1	1.79
2	.503	25	58.9	12.0	1.81
4	.490	24	58.3	12.9	2.10

All units were operated at 2 gal. per min./sq.ft.

Filters 1 to 6 contained sand sent by James W. Armstrong.

Filters 7(S-1) and plant filters 2 and 4 contained Muscatine sand.

Filter 8(J-3) contained water-worn anthracite.

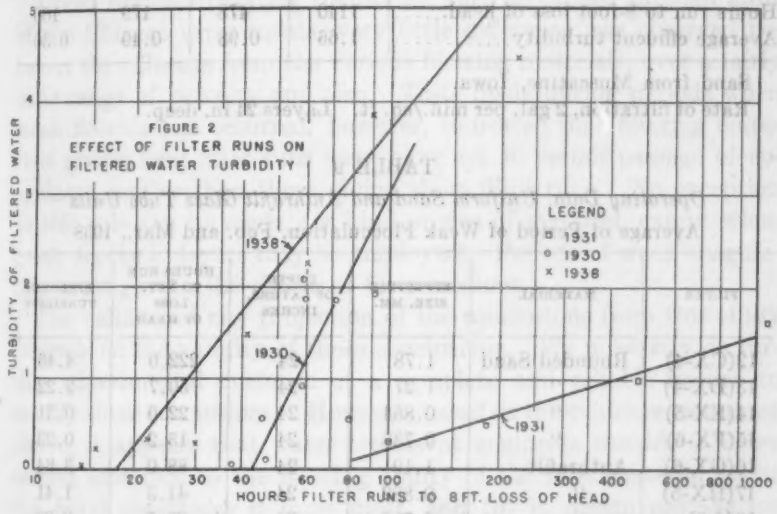
Filters 1 to 8 were glass tubes; filter 2 had 100 sq.ft. area, and filter 4 had 10 sq.ft. area.

the period covered by table 3, and the anthracite unit gave longer filter runs than the sand unit. In table 4 and fig. 1 it is shown that angular materials gave longer filter runs than rounded materials. Increased porosity lengthened filter runs, but anthracite showed no advantage, insofar as filter runs or water quality were concerned, over any other angular material in this series.

Glass tube filter 8(J-3) contained rounded anthracite. Results from this unit were inferior (see table 7) to those from the sands in the other glass tube units. It must be considered, however, that

these tests were limited to daily measurements over only a two-month period, and that the contrast might not have been quite as great had more periods of weak flocculation occurred during which tests could have been made.

In general, it is desirable to continue experiments on filtering materials in daily operation over a period of at least a year, in order to include all seasonal variations. The data on weak flocculation given in this paper have been selected from much more extended experiments on the filters and hence quite well represent the selection of the worst (or controlling) periods. Sometimes, a year's data are not enough, if no limiting period of weak coagulation occurs during that year.



As a further check on the comparative performance of angular and rounded materials, another series of eight glass tube filters was placed in service in August, 1937. Of these units, four contained rounded Muscatine sand and four contained crushed anthracite (Anthrafilt). These materials were very uniform in size. Although the data have been accumulating for some time, no analysis has been made of the full period of operation. Only two months of this period were of particular interest; February and March, 1938. During these two months a fairly severe period of weak flocculation occurred. This offered an excellent chance to determine the relative merits of the two types of filtering materials under decisive conditions.

Table 9 gives the effective size of these eight materials, the depths of layers, lengths of filter runs to 8-foot loss of head and the effluent turbidity for the critical two-month period. When the hours filter runs were plotted against effluent turbidity (see fig. 2), it was immediately seen that this series of experiments corroborated the finding of the other two series of tests made during period of weak

TABLE 8

Operating Data, Uniform Sand Glass Tube Filters

Average of Period January 12, 1931 to May 13, 1931

FILTER	1(M-2)	2(N-2)	3(Y-1)	4(P-2)
Effective Size, mm.....	1.78	1.27	.854	.738
Hours run to 8-foot loss of head.....	1140	478	179	100
Average effluent turbidity.....	1.66	0.98	0.49	0.30

Sand from Muscatine, Iowa.
Rate of filtration, 2 gal. per min./sq. ft. Layers 24 in. deep.

TABLE 9

Operating Data, Uniform Sand and Anthrafilt Glass Tube Units

Average of Period of Weak Flocculation, Feb. and Mar., 1938

FILTER	MATERIAL	EFFECTIVE SIZE, MM.	DEPTH OF LAYERS, INCHES	HOURS RUN TO 8 FT. LOSS OF HEAD	EFFLUENT TURBIDITY
12(CX-4)	Rounded Sand	1.78	24	222.0	4.46
13(DX-4)	"	1.27	24	59.7	2.22
14(EX-5)	"	0.854	24	22.0	0.31
15(FX-6)	"	0.738	24	15.2	0.23
16(GX-6)	Anthrafilt	1.19	24	88.0	3.84
17(HX-5)	"	0.882	24	41.3	1.41
18(J-6)	"	0.712	24	29.5	0.26
19(Z-5)	"	0.509	24	13.8	0.075

Units were operated at 4 gal. per min./sq.ft.

flocculation. It appears from these data and the resulting curves in fig. 2 that: for a given applied water when coagulation is weak, the quality of filtered water bears a definite relationship to the lengths of filter runs produced by various filter materials. Filter materials tending to give long runs seem to produce poorer water than those giving shorter runs, regardless of the composition of the filter material particles.

CONCLUSIONS

As a result of the figures given in this paper, the following conclusions are drawn:

Glass tube filters have given results comparable to those obtained from large units when monthly averages are used.

Filter runs on ten different filter media varied as the 3.8 power of the porosity of the filtering material, indicating that angular materials give longer filter runs than rounded.

Choice of filter material should be dictated not by isolated tests, nor by general averages, but by consideration of the filter effluent quality during the worst conditions under which the material may be called upon to operate.

Under normal operating conditions, such as existed through most of the Chicago experiments, very little difference was observed between the effluents from the various filtering materials, over a fairly wide range of porosity and size. Tests made during periods when weak flocculation occurred, however, indicated that filtering materials giving long filter runs were more apt to permit passage of coagulated matter than those giving short filter runs. No exception to this rule can be made, for kind or size of material, except when great depths in layers may be employed. Periods of weak coagulation must govern the choice of filter medium.

The validity of any projection of the conclusions from this study depends on the validity of those conclusions. We must rely on further experimental evidence of a complete and reliable nature to modify these conclusions. However, based on the evidence contained above, it appears that water treatment engineers should: (a) give careful attention to the filtering ability of the filter material under the worst conditions it must meet, and (b) in design provide for maximum conditions, as well as for average conditions.

The selection of filtering materials should be governed primarily by their ability to safeguard the public health at all times, and secondarily by economic considerations. This study indicates the desirability of selecting filtering material primarily on a basis of its effectiveness in removing suspended impurities from water and secondarily on a basis of cost. Naturally the cost of the filtering material will be influenced by the practicability of operation of the material.

We are now reaching the point at which we have enough evidence to begin selection of filtering materials on the basis of performance measurements. Heretofore, we have selected filtering materials

on the basis of generalized experience in plant scale operation. These generalized observations were necessarily crude, and they led us to the present rule-of-thumb methods of design. Now that more precise data are becoming available, common sense and the public health demand that we use such data as the basis for filter material selection.

ACKNOWLEDGEMENTS

The data for the period of weak coagulation during 1929, 1930 and 1931 were collected prior to the writer's employment at the Experimental Filtration Plant. It was necessary to use these data in this paper because they were the only figures on periods of extremely weak flocculation which were available. Turbidity measurements were made by Oscar Gullans, senior sanitary chemist, and the late C. A. McCoy, laboratory assistant.

The experiments described in this paper were made under the direction and guidance of John R. Baylis. The writer is indebted to him for his advice and experience in making the analysis of these data. The Experimental Filtration Plant is under the supervision of the Division of Water Purification, Bureau of Engineering, Department of Public Works, Chicago, Illinois. Oscar Hewitt is Commissioner of Public Works; Loran D. Gayton, City Engineer; and A. E. Gorman, Engineer of Water Purification. The writer is grateful to Mr. Gorman for numerous comments and suggestions on this paper.

REFERENCES

1. Baylis, J. R. A Study of Filter Materials for Rapid Sand Filters. Part II. A New Method for Determining the Effective Size of Sand. W. W. and Sew., **81**: 162 (May, 1934).
2. Baylis, J. R. A Study of Filter Materials for Rapid Sand Filters. Part III. Various Kinds of Filtering Materials. W. W. and Sew., **81**: 352 (Oct., 1934).
3. Baylis, J. R. A Study of Filter Materials for Rapid Sand Filters. Part VI. Mud Ball Formation and Measurement—Miscellaneous Items. W. W. and Sew., **82**: 327 (Sept., 1935).
4. Baylis, J. R. A Study of Filter Materials for Rapid Sand Filters. Part VII. Specifications for Filtering Material. W. W. and Sew., **83**: 20 (Jan., 1936).
5. Farrell, M. A., and Turner, H. G. Fine Anthracite and Sand. W. W. Eng., **84**: 1673 (Dec. 2, 1931).
6. Farrell, M. A. The Use of Anthracite Coal as a Filter Medium. Jour. A. W. W. A., **25**: 716 (May, 1933).

7. TURNER, H. G., AND SCOTT, G. S. Clarification of Water Supplies by Filtration Through Anthracite. W. W. and Sew., **80**: 330 (Sept., 1933).
8. TURNER, H. G., AND SCOTT, G. S. Accounting for Anthracite's Superiority to Sand as a Filter Medium. W. W. and Sew., **80**: 330 (Sept., 1933).
9. HOOVER, C. P. Experience with Anthracite Coal as a Filter Medium for Water Softening. W. W. and Sew., **80**: 394 (Nov., 1933).
10. RIPPLE, O. J. Anthracite and Sand as a Filter Medium. W. W. Eng., **88**: 277 (Mar. 20, 1935).
11. RIPPLE, O. J. Experience with Anthracite as a Filter Medium. W. W. and Sew., **83**: 255 (Sept., 1936).
12. Report of the Committee on Filtering Materials. Jour. A. W. W. A., **24**: 1319 (Sept., 1932).
13. COOK, ARTHUR T. Anthrafilt Increases Capacity of Pressure Filters. W. W. Eng., **89**: 1215 (Sept. 16, 1936).
14. SMITH, M. C. Raw Water Preparation vs. Filter Design. W. W. and Sew., **83**: 351 (Sept., 1936).
15. Progress Report of the Committee on Filtering Materials. Proc. A. S. C. E., Dec., 1936, p. 1543.
16. BAYLIS, J. R. Experiences in Filtration. Jour. A. W. W. A., **29**: 1010 (July, 1937).
17. HUDSON, H. E., JR. A Method for Calculating Efficiency of Filtration. Eng. News-Rec., **114**: 528 (April 11, 1935).
18. BAYLIS, J. R. Filter Sand Studies. W. W. and Sew., **79**: 47 (Feb., 1932).
19. CAMP, THOMAS R. Discussion of Report of A. S. C. E. Committee Report on Filtering Materials. Proc. A. S. C. E., **63**: 769 (April, 1937).
20. ALLAN, L. F. Filter Sand Experiments. Jour. A. W. W. A., **27**: 205 (Feb., 1935).

DEVELOPMENTS IN WATER BACTERIOLOGY

By R. F. Goudey

This paper is a discussion of the results of three years of research by the Sanitary Engineering Division of the Bureau of Water Works and Supply of the City of Los Angeles. An attempt is made to adjust *Standard Methods of Water Analysis* with field conditions and thereby select a procedure which would best indicate dangerous contamination.

For the past three years the Sanitary Engineering Division has analyzed over 90,000 bacteriological samples of which 82,000 were made sufficiently complete, including the indol, citrate, methyl red, and Voges-Proskauer reactions, to divide over 36,000 positive samples into the following five bacteriological groups: first, *Escherichia coli* in which lactose broth, eosine methylene blue plates, lactose broth replant, methyl red, indol, and morphology reactions were positive, and citrate and Voges-Proskauer reactions were negative; second, doubtful *Esch. coli* in which the reactions were the same as for *Esch. coli* except controlled eosine methylene blue plates were negative for typical *Esch. coli*; third, intermediate *Esch. coli*-group in which the eosine methylene blue, methyl red, Voges-Proskauer, indol, and citrate reactions were irregular; fourth, *Aerobacter aerogenes* in which eosine methylene blue, methyl red, and indol were negative and Voges-Proskauer and citrate were positive; and fifth, organisms outside the coliform group in which eosine methylene blue or lactose replants were zero, lactose fermentation was due to spores, or morphology was negative. These groupings have been summarized for average monthly results for a three year period.

In addition to the above mentioned studies, special investigations included: first, a comparison of lactose broth results quantitatively according to various bacteriological groups as above outlined of 5,536 samples run parallel with direct counting on ferrocyanide

---

A paper presented at the California Section meeting at Riverside, Calif., October 27, 1938, by R. F. Goudey, San. Eng., Dept. of Water and Power, Los Angeles, Calif.

citrate agar; and, second, the development of a new medium by Mrs. Madeline Lake, water bacteriologist of the Sanitary Engineering Division, called brilliant green-crystal violet broth for use as a primary or confirming medium to increase recovery of *Esch. coli* and to inhibit spores and natural water bacteria. Only 600 parallel samples were run using this medium for primary inoculation.

The bacteriological results have been further segregated according to four types of waters to compare the reliability of various bacteriological indices with field conditions. The different types of waters include samples as follows:

1. Los Angeles and Owens Rivers. These samples do not represent raw city water but were selected as contaminated waters to check procedures throughout. Indirectly, the Los Angeles River supplies underground sources for wells and galleries. The Owens Valley streams when not spread or used for irrigation become subjected to long storage, six to nine months, so that they are considered remote sources as far as contamination is concerned. Except for a short period last March, there was no direct discharge of sewage into the Los Angeles or Owens Rivers and these supplies were only relatively polluted.

2. City Sources. This represents stored water which may be periodically contaminated from rains from November to March or by mudhens or seagulls lighting on the reservoirs in October. It also includes gallery and well supplies which are clear but occasionally slightly contaminated. In all cases there was no direct discharge of sewage into any of these sources.

3. Untreated Distribution Samples. This group includes long stored waters and wells at times when reservoirs showed no effect of flood waters but which might during October have been polluted by mudhens and seagulls.

4. Cholorinated Distribution Samples. All aqueduct supplies delivered in the San Fernando Valley during the rainy period were chlorinated with residual control equipment, and the major portion of this chlorinated water was rechlorinated before use in the main city system and also by residual control equipment. All Los Angeles River gallery waters were treated automatically with chlorine and ammonia. The chlorination equipment in all instances was located at the reservoir outlets.

The studies also included a comparison between 24-hour and 48-hour gas formation.

The following sequence was adopted to present the data in a logical order:

1. The monthly distribution of all lactose fermenters.
2. Monthly distribution of lactose fermenters between raw and final waters.
3. Lactose fermenters arranged according to bacteriological groups.
4. Lactose fermenters arranged according to bacteriological groups and types of waters.

TABLE 1

Monthly distribution of 24- and 48-hour lactose presumptive tests

MONTH	SAMPLES	PER CENT POSITIVE			RATIO OF 24-HOUR TO 48-HOUR
		24-hour	48-hour	Total	
January	7,190	5.7	41.1	46.8	7.2
February	6,676	8.4	48.4	54.8	5.7
March	7,774	12.5	50.6	63.1	4.0
April	7,521	6.2	42.1	48.3	6.8
May	6,853	8.7	31.8	40.5	3.7
June	6,892	8.5	29.6	38.1	3.5
July	6,302	7.5	25.7	33.2	3.4
August	6,306	7.2	28.6	35.8	4.0
September	5,968	9.2	28.9	38.1	3.1
October	6,395	11.9	31.7	42.6	2.7
November	6,535	8.1	33.4	42.5	4.1
December	7,342	7.4	32.5	39.9	4.4
Total	81,754	8.5	35.8	44.2	4.2

5. Distribution of the *Esch. coli* and coliform group members for various types of waters.
6. Ratio of 48-hour presumptive lactose tests to the total 24-hour and 48-hour samples.

The monthly distribution of all lactose fermenters is given in table 1.

The following points should be noted: 1. The 48-hour lactose presumptive tests outnumber the corresponding 24-hour tests four to one. 2. The 24-hour monthly tests do not consistently show high results during the rainy season or low results during dry summer periods. 3. The 48-hour lactose fermenters are highest during the rainy period and lowest during the summer. 4. The total 24- and

48-hour lactose positives expressed as percentages to the total samples indicate more positive samples during February and March with a minimum from June to September, inclusive. 5. The range in the ratio of 24- to 48-hour presumptive tests varies from 4.0 to 7.2 during the wet season and 2.7 to 4.0 during the summer.

The obvious fact is that the 48-hour lactose fermentation predominates throughout the year and particularly during the winter when contamination logically should be at a maximum. Since the 48-hour lactose gas formation is a "doubtful" test according to *Standard Methods of Water Analysis* (1), it is clear that lactose broth

TABLE 2

Monthly distribution of lactose fermenters, raw and final waters

MONTH	LOS ANGELES AND OWENS RIVER AND CITY SOURCES (RAW)			FINAL WATERS UNTREATED AND TREATED DISTRIBUTION		
	24-hr. of Total 24	48-hr. of Total 48	24- and 48-hr. to Total	24-hr. of Total 24	48-hr. of Total 48	24- and 48-hr. to Total
January....	52.5	12.3	8.1	47.5	87.7	9.6
February...	56.4	8.8	8.3	43.6	91.2	11.0
March.....	40.1	8.6	10.1	59.9	91.4	14.5
April.....	47.1	10.8	7.8	52.9	89.2	10.6
May.....	39.2	17.4	8.5	60.8	82.6	7.5
June.....	34.5	19.9	8.4	65.5	80.1	7.0
July.....	42.2	20.5	7.4	57.8	79.5	5.3
August.....	54.4	22.9	8.7	45.6	67.1	5.6
September..	47.8	20.4	8.5	52.2	79.6	5.7
October....	43.0	24.0	9.5	57.0	86.0	7.3
November..	44.6	14.2	7.5	55.4	85.8	7.5
December..	45.8	11.4	7.2	54.2	88.6	8.4
Average..	44.5	14.2	100.0	55.5	85.8	100.0

is not only interfering with the detection of coliform members but is also complicating analyses at a time when the most dangerous organisms might be present.

In table 2 is included the total lactose gas formation for raw and final waters expressed in relation to the total 24- and 48-hour presumptive tests for all samples. In addition, the percentage distribution of 24- and 48-hour presumptive tests for raw and final waters is given respectively.

The 24-hour presumptive lactose tests show that almost the same percentage of final waters were positive as were the raw waters and

the greatest percentage of 24-hour positive lactose fermenters was during May and June in the final waters. This certainly is contrary to logic and points conclusively to the unsuitability of lactose broth as a primary medium.

The majority of the 48-hour lactose presumptive positive samples occurred in the treated water in the winter time which indicates that the greatest interference for the coliform group occurs when the water should logically be most contaminated.

The greatest number of total 24- and 48-hour lactose fermenters

TABLE 3

Percentage of positive samples in bacteriological groups

MONTH	*Esch. coli*		DOUBTFUL *Esch. coli*		INTERMEDIATES		*Aer. aerogenes*		NOT COLIFORM	
	24-hour	48-hour	24-hour	48-hour	24-hour	48-hour	24-hour	48-hour	24-hour	48-hour
January	40.3	1.3	17.9	2.7	12.3	4.2	6.1	1.5	23.4	90.3
February	44.5	0.8	18.5	3.6	8.7	3.8	3.4	1.1	24.9	90.7
March	45.3	0.8	16.7	2.5	7.8	4.0	3.6	1.0	26.6	91.7
April	52.3	1.7	16.1	3.8	7.0	4.3	5.6	1.4	19.0	88.8
May	53.7	2.8	22.8	8.1	9.5	8.9	5.5	2.8	8.5	77.4
June	45.5	3.6	18.5	8.3	15.1	14.5	13.4	6.2	7.5	67.4
July	36.8	6.9	21.3	7.7	10.9	5.9	23.2	11.3	7.8	68.2
August	29.5	3.2	26.7	11.9	8.8	8.8	23.2	23.2	11.8	66.8
September	24.5	3.3	15.5	8.5	17.8	10.0	31.3	9.6	10.9	68.6
October	33.4	2.0	22.6	7.8	19.9	9.4	13.3	7.7	10.8	73.1
November	45.4	2.8	18.1	4.7	18.6	8.3	11.2	4.9	6.7	79.3
December	42.3	1.6	19.3	3.1	16.0	7.0	13.7	2.8	18.7	85.5
Average	41.5	2.1	19.5	5.3	12.3	6.9	12.2	4.1	14.5	81.5

was during March and the least in July, showing that lactose fermenters as a group are a better index of alarm than the coli-aerogenes group as will later be shown.

In table 3 is given the 24- and 48-hour lactose fermenters separated by their respective percentages into various bacteriological groups. This table indicates the following:

1. Approximately 41.5 per cent of the 24-hour presumptive samples and 2.1 per cent of the 48-hour presumptive samples were confirmed for *Esch. coli.* The highest 24-hour percentage was confirmed in April and May and the lowest was in August. The

highest 48-hour percentage was in July when the water was at its best and the lowest in February when the water was at its worst.

2. Doubtful *Esch. coli* had about one-half of the 24-hour percentage as the *Esch. coli* group, but the 48-hour percentage was two and one-half times higher. The 24-hour percentage was greatest in August when the water was good and lowest in September. The 48-hour percentage was greatest in August and lowest in March. The doubtful *Esch. coli* results conflict directly with field results and it appears that the negative eosine methylene blue should rule doubtful *Esch. coli* out as an organism indicative of dangerous contamination.

3. In the intermediate group the highest percentage of the 24-hour tests was in October and the lowest in April. The 48-hour percentage was at its greatest in June and lowest in February. This also shows that this group is without sanitary significance although, as in the former case, according to *Standard Methods* the water would be said to contain the coliform group.

4. *Aer. aerogenes* was at its maximum for the 24-hour percentage of samples in September, and August for the 48-hour samples. The lowest for both 24- and 48-hour percentages was in February and March. This shows that *Aer. aerogenes* is an indication of safety in the absence of *Esch. coli* instead of being a possible organism of danger.

5. The doubtful *Esch. coli*, intermediate coliform groups, and *Aer. aerogenes* all have a higher ratio of 24-hour gas over the 48-hour gas, yet, when correlated with field conditions, have absolutely no sanitary significance.

6. The lactose gas formers which proved to be not the coliform group and so recognized by *Standard Methods* showed a ratio of 24- to 48-hour percentages of 1 to 5.6. The highest 24-hour percentage was in January, February, and March, and the lowest in November. These lactose fermenters enter during the winter rains and persist all year. The highest 48-hour percentage was in January, February, and March, similar to the 24-hour results, and the lowest was in June. During March, 91.7 per cent of all the 48-hour lactose gas formers belonged out of the coliform group. Is there wonder that *Esch. coli*, if originally present, might not be overgrown and might not lactose broth be the wrong medium in this case to detect dangerous contamination?

In fig. 1 is indicated how the 24- and 48-hour presumptive tests

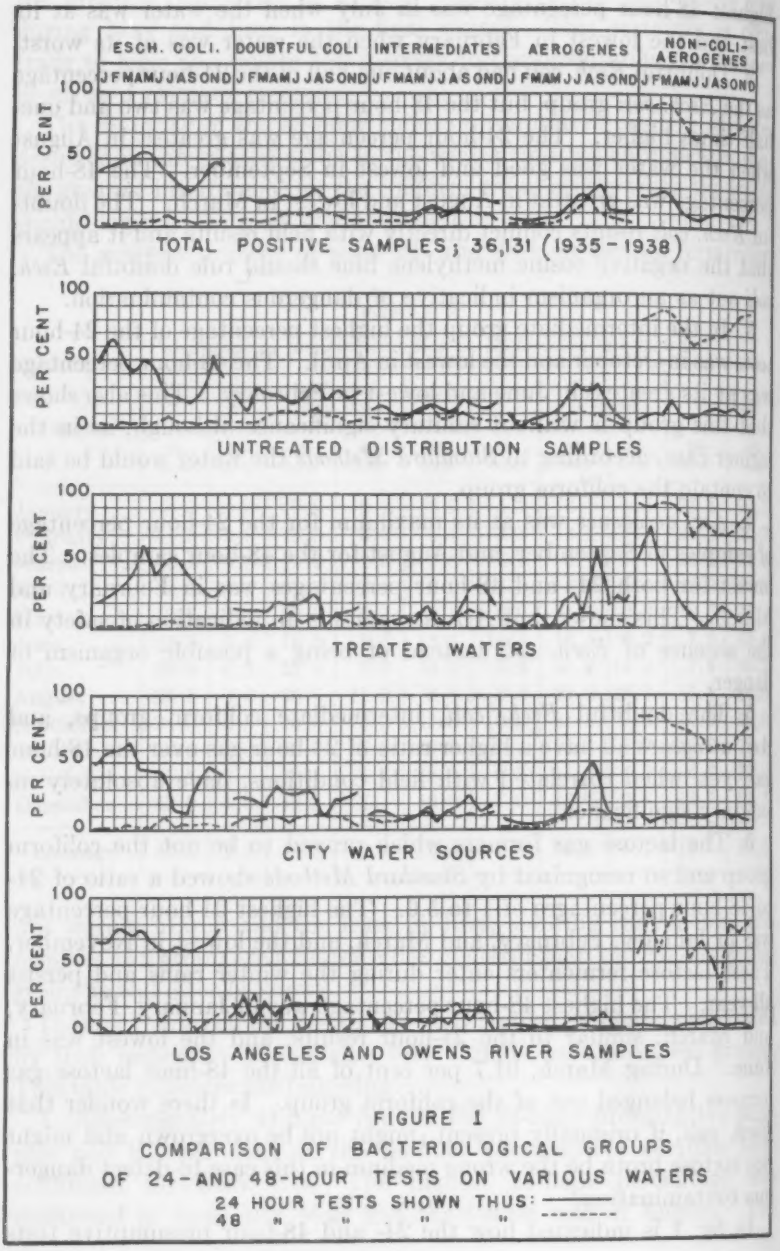


FIGURE 1

COMPARISON OF BACTERIOLOGICAL GROUPS OF 24- AND 48-HOUR TESTS ON VARIOUS WATERS

24 HOUR TESTS SHOWN THUS: ———

48 " " " " --------

each vary in percentages of bacteriological groups to the total 24- and 48-hour presumptive lactose tests for various types of waters. It should be borne in mind that the 24- and 48-hour percentages are based on different numbers of samples and, therefore, cannot be added together. Figure 1 shows the following:

1. Los Angeles and Owens Rivers Samples. About 66 per cent of all the 24-hour presumptive samples were *Esch. coli*, 18 per cent doubtful *Esch. coli*, 10 per cent intermediate, 30 per cent *Aer. aerogenes*, and 3 per cent as not belonging to the coliform group. In the 48-hour group about 9 per cent were *Esch. coli*, 13 per cent doubtful *Esch. coli*, 10 per cent intermediate, 4 per cent *Aer. aerogenes*, and 64 per cent as not belonging to the coliform group. The highest 24-hour *Esch. coli* content was in March, but contamination was high during all months of the year.

2. City Sources. The results for the city sources showed less 24- and 48-hour *Esch. coli* than the Los Angeles and Owens Rivers samples. Again, as in the Los Angeles and Owens Rivers samples, there was a high 24-hour *Esch. coli* content (43 per cent) and a high 48-hour non-coliform group (72 per cent). The maximum 24-hour *Esch. coli* count was in March and the lowest was in August and September as would be expected from field surveys.

It is noted further that the 24-hour "doubtful" *Esch. coli* was a maximum during May. This is not consistent with times of more severe pollution. The maximum 24-hour intermediate coliform content was in October which definitely rules that group out as an index group for dangerous contamination. *Aer. aerogenes* for both 24- and 48-hour presumptive tests was maximum during September at the end of the harvest season.

3. Untreated Distribution Samples. The ratio of *Aer. aerogenes* to *Esch. coli* of the untreated distribution samples was compared with city water sources and its maximum was also during July, August, and September. The doubtful *Esch. coli* content was practically uniform, increasing during the summer season, and was lowest during February.

4. Chlorinated Distribution Samples. The highest 24-hour *Esch. coli* content was during the summer and the lowest during the winter, with the 48-hour count practically zero all year. This was probably due to many of the chlorinators being shut down during the summer period and just a few samples showing a high percentage with 24-hour

gas formation. The total 24- and 48-hour *Esch. coli* varied only from 4 to 8 per cent for the entire year.

About equally as high as the 24-hour *Esch. coli* group was the non-coliform group which had its maximum during February and declined steadily to July.

In table 4 are given the percentages of *Esch. coli* and the coliform group for different types of water averaged for months of the year. The coliform group includes the total presumptive lactose fermenters less those organisms outside the coliform group.

It is interesting to note that the coliform group for both raw and final waters is a maximum from May through October during the

TABLE 4

Esch. coli and coliform per cent samples by months

MONTH	*Esch. coli*			COLIFORM		
	Raw Waters	Final Waters	Total	Raw Waters	Final Waters	Total
January	7.5	4.4	5.8	6.0	4.1	5.1
February	10.6	5.2	7.9	7.0	5.2	5.7
March	14.0	12.8	13.5	7.4	7.3	7.3
April	9.3	7.7	8.5	5.2	5.6	5.5
May	8.3	13.4	10.9	7.1	9.0	8.4
June	6.9	12.4	9.7	8.1	12.5	11.1
July	7.4	8.9	8.2	7.7	8.9	8.5
August	5.3	5.7	5.5	12.0	9.6	10.3
September	5.6	5.3	5.5	12.1	10.2	10.7
October	8.7	8.1	8.3	13.1	11.4	11.9
November	8.1	9.0	8.5	7.4	8.6	8.2
December	8.3	7.1	7.7	6.9	7.6	7.3

summer season when contamination is at a minimum. The coliform group is, therefore, not a suitable index to gauge the safety of the Los Angeles water supply. According to *Standard Methods* more contamination is noted in the summer than in the winter time. This is ridiculous. The *Esch. coli* group has a maximum in March and a minimum in August and September. This is in harmony with field conditions. There is a general agreement in the winter variations of both the *Esch. coli* and coliform groups, whereas in the summer there is a decided contrast.

In table 5 is given the ratio of 48-hour presumptive samples to the total 24- and 48-hour samples for the different types of waters. The

TABLE 5

Percentage of 48-hour gas to total 24- and 48-hour gas of three major bacterial groups—for various sources

	L. A. AND OWENS RIVERS			CITY SOURCES			UNTREATED DIST.			TREATED DIST.			TOTAL SAMPLES		
	C*	C? † Int. A.	Not C-A‡	C	C? Int. A.	Not C-A	C	C? Int. A.	Not C-A	C	C? Int. A.	Not C-A	C	C? Int. A.	Not C-A
January	3.1	24.2	100.	6.9	44.8	94.5	16.6	56.9	95.4	47.2	77.6	96.7	18.2	62.1	96.5
February	0	43.5	100.	1.4	29.0	94.4	23.5	88.0	91.8	28.9	81.1	95.2	10.1	61.5	95.3
March	0	28.0	90.8	1.7	27.9	91.7	89.5	30.0	94.5	13.6	69.7	93.5	6.6	52.1	90.9
April	0	13.8	100.	12.9	61.7	95.5	29.4	98.5	98.4	29.7	72.5	96.8	18.0	68.8	96.8
May	1.4	0	78.0	14.1	53.5	95.9	19.8	69.3	97.4	26.3	80.0	97.6	15.9	65.5	97.1
June	3.3	10.0	60.0	17.0	69.5	96.5	28.3	71.4	97.0	21.4	72.3	98.5	21.4	68.2	96.9
July	0.1	6.7	75.0	42.2	61.1	96.7	55.3	62.5	96.4	42.3	75.8	99.5	39.0	60.5	96.7
August	0.6	17.1	55.6	38.5	62.7	94.6	46.3	71.1	96.4	33.3	80.0	98.8	30.0	66.9	96.0
September	2.9	15.4	57.1	44.8	50.6	91.7	44.3	62.3	96.0	43.7	81.5	97.4	29.7	57.7	95.3
October	0	6.7	78.5	15.2	48.7	94.0	13.9	51.6	93.4	36.1	78.1	98.0	13.6	54.4	94.7
November	0.1	8.3	84.6	18.4	55.2	94.4	22.3	51.6	97.3	42.1	71.7	99.1	20.7	60.8	98.1
December	2.6	4.2	91.7	7.5	40.4	96.1	33.3	58.1	97.6	24.3	60.9	98.1	14.5	53.6	92.3
Average	2.0	11.6	79.6	15.3	51.1	94.6	29.4	64.5	96.1	28.2	74.1	96.3	18.8	61.2	96.0

* *Esch. coli.*

† Questionable *Esch. coli*, intermediates, and *aerogenes*.

‡ Non-coliform members.

"doubtful" *Esch. coli*, intermediates, and *Aer. aerogenes* have been combined into one group.

A low ratio of 48-hour to the total 24- and 48-hour presumptive indicates more likelihood of coliform organism being *Esch. coli* than *Aer. aerogenes* or intermediate groups. It is noted that for *Esch. coli* the ratio for Los Angeles and Owens Rivers was 2.0, for city water sources was 15.3, for untreated distribution samples was 29.4, and for the treated samples was 28.2. Compare these ratios in the non-coliform group where the Los Angeles and Owens Rivers ratio was 79.6, the ratio for city sources was 94.6, for untreated distribution samples was 96.1, and for treated samples was 96.3.

The significance of this range in 48-hour presumptive tests is twofold. First, it indicates that the preponderance of 48-hour gas formation was due to organisms outside the coliform group, and, second, that if *Esch. coli* were present it might easily be overgrown and be eliminated.

TABLE 6

Ratio of 24- to 48-hour presumptive sample

Polluted water	1 to 0.03
City sources	1 to 0.48
Untreated distribution samples	1 to 0.98
Chlorinated distribution samples	1 to 2.25

It should be further noted that the nearer one approaches the non-coliform group of the water lactose fermenters, the greater is the ratio of 48-hour presumptive test to the 24-hour presumptives. Likewise, the contaminated waters have the lowest 48-hour counts during the rainy season as would be expected and the highest in the summer and fall seasons.

In the treated waters the lowest ratio of the 48-hour gas presumptive tests to the total 24- and 48-hour gas formation was 60.9 for all the doubtful *Esch. coli*, intermediates, and *Aer. aerogenes*, and that during the year this value averaged 74.1 with a maximum of 81.5. It would appear, also, from this that this group is of little sanitary significance for the Los Angeles water.

It is significant that the ratio of 24- to 48-hour presumptive tests reversed itself (see table 6) from the polluted to treated waters of the following very wide range which further emphasizes the fact that 48-hour presumptive lactose tests are of little sanitary significance.

This study clearly indicates that the eosine methylene blue negative results on 24-hour gas formation should be called zero *Esch. coli* and that more 48-hour results are called positive for *Esch. coli* according to *Standard Methods* than is justified.

PARALLEL PLATING ON FERROCYANIDE CITRATE AGAR AND COMPLETED LACTOSE BROTH

Over 5,536 parallel tests were made on ferrocyanide citrate medium to differentiate between *Esch. coli* and *Aer. aerogenes* on one hand with *Esch. coli*, doubtful *Esch. coli*, intermediate coliform, *Aer. aerogenes*, and lactose fermenters not belonging to the coliform group on the other hand. This work was carried uniformly over a three-year period on representative samples to cover seasonal variations in different types of waters. The tests were made with 100 c.c.

TABLE 7

Comparative productivity of methods

1. Total samples compared	5,536
2. Total samples positive on direct method	1,588
3. Percentage of positive samples by direct method	29.6%
4. Total samples positive lactose presumptive	2,778
5. Percentage of positive lactose presumptive tests	50.2%
6. Total complete coliform lactose samples	1,302
7. Percentage of completed lactose samples	23.6%

of water on direct plating as compared with 50 c.c. in lactose broth.

In comparing these media there should be a correlation between *Esch. coli* and *Aer. aerogenes* of the direct method with *Standard Method* coliform index. The *Esch. coli* of the direct method should equal the *Esch. coli* index where a differentiation is made between *Esch. coli* and *Aer. aerogenes*, although the *Esch. coli* will contain the "intermediate" organisms.

Table 7 gives pertinent data regarding the comparative productivity of these two methods. The ferrocyanide citrate medium gave more positive samples of the coliform group by 6 per cent than did lactose broth. Of the positive samples for both ferrocyanide citrate media and lactose broth the latter gives higher coliform and *Esch. coli* indices than does the former as indicated by table 8.

It is noted for the total figures that the coliform index is over twice the *Esch. coli* + *Aer. aerogenes* of the direct method and the

index is over twice the *Esch. coli* of the direct method. Lactose broth gives too high indices as compared with ferrocyanide citrate medium. The polluted water shows the greatest divergence and the treated water shows ferrocyanide citrate medium with both higher coliform and coli indices than lactose broth.

TABLE 8

Comparison of direct plates with lactose broth for various sources

SOURCE	NO. OF SAMPLES	ORGANISMS PER C.C.				
		Direct Method			Lactose Indices	
		Esch. coli	*Aer. aerogenes*	coli + aerogenes	coliform	*Esch. coli*
L. A. and Owens Rivers	608	3.45	8.68	12.13	30.10	12.90
City sources	778	.045	.017	.062	.074	.035
Untreated	1,048	.002	.001	.003	.010	.004
Treated	344	.013	.010	.023	.017	.006
Total	2,778	1.13	1.91	3.04	6.62	2.84

TABLE 9

Ferrocyanide citrate counts compared with bacteriological groups as determined by lactose broth

	NO. OF SAMPLES	AVERAGE ORGANISMS PER C.C.				
		Direct Plating			Lactose Indices	
		Esch. coli	*Aer. aerogenes*	coli + aerogenes	coliform	*Esch. coli*
Total coli	702	2.490	4.350	6.840	18.00	9.63
Coli (doubtful)	250	1.310	2.410	3.720	10.86	4.25
Intermediates	197	5.020	7.820	12.840	12.05	.33
Aer. aerogenes	153	.194	.352	.546	5.36	.01
Non-coliform	1,476	.023	.035	.058	0	0
Total	2,778	1.13	1.91	3.04	6.62	2.84
Ratio of indices to direct method					2.2	2.5

A study was made of *Esch. coli*, doubtful *Esch. coli*, intermediates, aerogenes and non-coliform lactose fermenters for waters of different sources. Since the same tendency has been noted in all tabulations only one has been included in this report, namely, the total summary of all types of waters as given in table 9.

The coliform index for the total samples is over twice that indicated by the direct method and the coli index is 2.5 times higher. It is significant that under the aerogenes group as isolated by the lactose broth procedure that the *Aer. aerogenes* by that method was about fifteen times that indicated by the direct method, and the direct method included 194 times as much *Esch. coli* as measured by *Standard Methods*. The inference is that *Esch. coli* originally present in the lactose broth became overgrown by *Aer. aerogenes* and indicates the non-suitability of lactose broth to recover *Esch. coli* when present.

It is further noteworthy that 21.5 per cent of the samples proven by the lactose broth method as not belonging to the coliform group showed up positive on ferrocyanide citrate medium. Table 9 showed that 1,476 plates had an average *Esch. coli* count of 0.023 and an *Aer. aerogenes* count of .035 per c.c. The actual average on the ferro-cyanide plates which were positive was 0.106 per c.c. for *Esch. coli* and 0.160 per c.c. for *Aer. aerogenes*. This is another indication of lactose broth not recovering *Esch. coli* in the presence of *Aer. aerogenes*, and where, even if both *Esch. coli* and *Aer. aerogenes* are present in high numbers, where lactose broth was unable to recover any of the coliform members.

A further study was made of the 24- and 48-hour lactose broth final indices compared with ferrocyanide citrate agar counts. Lactose broth in 24 hours recovered 1.6 times as many coliform members as did ferrocyanide citrate medium. The 48-hour lactose broth index was 7.4 times that of the solid medium. Since the 48-hour lactose broth is a "doubtful" test of the coliform group according to *Standard Methods*, the 48-hour ratio of lactose broth to the solid medium should have been less than 1.6. This is further evidence that the 48-hour lactose broth gives results considerably higher than is warranted by ferrocyanide citrate medium.

BRILLIANT GREEN-CRYSTAL VIOLET USED AS PRIMARY MEDIUM

As indicated above, lactose broth is too productive for non-coliform organisms and probably obscures *Esch. coli* when overgrown by natural water organisms. *Standard Methods* is recognizing an increasing number of confirmatory media designed to reduce this complication to a minimum.

The problem of non-coliform fermentation of lactose broth has been well stated by Salle (2). No effort will be made in this paper

to prove just what organisms are responsible for fermentation with Los Angeles waters. It is significant, however, that every attempt to isolate responsible organisms results in finding anaerobes akin to *Cl. welchi*, *Cl. tertium*, *Cl. butyricium*, and *Cl. sphenoides*, or occasional *aerospores* not completely identified but which ferment lactose, or quite frequently, natural water bacteria, some of which only rarely ferment lactose when in pure cultures. This later group includes organisms similar, if not equal, to *Proteus*, *Pseudomonas*, *Flavobacterium*, *Serratia*, *Cocci*, *B. subtilis*, and *B. mycoides*. It is very significant that so many attempts to isolate specific spore forming bacteria result in finding organisms which after their isolation no longer ferment lactose. The presumption surely must follow that enrichment and competition through successive steps cause coliform organisms to be lost. The fact that the ferrocyanide

TABLE 10

Ingredients of the new medium

Crystal Violet	1.5 ml. of 0.4 per cent solution
Brilliant Green	13.3 ml. of 0.1 per cent solution
K_2HPO_4	5 gm.
Ox Gall	20 gm.
Peptone	10 gm.
Lactose	10 gm.
Distilled Water	1000 cc.

citrate agar picks up *Esch. coli* where *Standard Methods* procedure is negative is strong evidence that *Esch. coli* are lost.

When lactose broth is used as a primary medium, these and other organisms compete with *Esch. coli* and the successful winner after passing through a list of inhibiting or segregating media could hardly be representative of bacterial balance as existed in the original sample.

If inhibitory media are useful at any stage of the procedure, why should it not be logical to inhibit as many as possible of the lactose fermenters having no sanitary significance at the start?

With this in mind, a combination of crystal violet and brilliant green was chanced upon by Mrs. M. Lake of this laboratory which gives promise not only to give higher *Esch. coli* indices than lactose broth but also to do so quicker. The medium is made according to table 10.

As yet, no real attempt has been made to perfect this medium for the most efficient application to Los Angeles waters. The plan has been that of encouraging *Esch. coli* with lactose broth and bile and discouraging fermenters other than *Esch. coli* by a combination of dyes affecting the greatest number of spurious lactose gas formers. Weaker *Esch. coli* strains apparently survive any slight inhibiting action crystal violet and brilliant green dyes might have on them better than they would against the competing water forms outside the coliform group if not partly inhibited.

This medium is productive with 24-hour gas formation for *Esch. coli*, doubtful *Esch. coli*, intermediates, and *Aer. aerogenes*, as used in this report and inhibits for at least 4 hours pure strains of *Proteus*, *B. subtilis*, *B. mycoides*, *Pseudomonas*, *Flavobacterium*, and *Serratia*. With mixed cultures in normal waters the inhibition of natural water bacteria is not as complete as desired.

During the years 1936–38 some 600 samples were analysed from three different types of water for all seasons of the year where comparative results were obtained by the lactose and brilliant green-crystal violet media for the presumptive, confirmed, and completed *Esch. coli* test. The completed test included methyl red, Voges-Proskauer, indol, citrate, and morphology, except that during 1937–38 no indol or citrate was used on the 24-hour gas formation for lactose broth.

Table 11 indicates parallel results in lactose broth and the brilliant green-crystal violet medium. From table 11 it is noted, first, that brilliant green-crystal violet medium on the completed test gave 16.7 to 21.4 per cent higher *Esch. coli* results than lactose broth did for contaminated surface water and regular raw waters of the city of Los Angeles. In treated and stored waters the brilliant green-crystal violet broth gave results 0.9 per cent lower than lactose broth. The total for all samples, raw and treated, showed the completed test for brilliant green-crystal violet only .1 per cent higher.

It clearly shows that lactose broth gives too low results in contaminated waters where *Esch. coli* is likely to be present in small amounts, and the reason for this loss of *Esch. coli* in lactose broth is undoubtedly due to *Esch. coli* being overgrown with other organisms. In the confirmed test, the brilliant green-crystal violet medium gave 13.3 to 20.8 per cent higher findings than lactose broth in raw water and .3 per cent in treated waters, again showing that with the more highly contaminated waters in greater numbers brilliant green-

crystal violet medium gave considerably higher results. In the presumptive test where the water is definitely contaminated with sewage, brilliant green-crystal violet gave 4.1 per cent more positive results than lactose broth, but in raw waters devoid of municipal sewage and containing miscellaneous contamination, the lactose broth was 20.8 per cent higher. This large percentage was due to the

TABLE 11

Parallel plating in lactose broth and brilliant green-crystal violet media

TYPE OF WATER	NO. OF SAMPLES	GAS PERIOD HOURS	PERCENTAGE OF SAMPLES					
			Presumptive		Confirmed		Completed	
			Lactose	B.G.-C.V.	Lactose	B.G.-C.V.	Lactose	B.G.-C.V.
1. Contaminated surface	24	24	91.7	100.0	54.2	75.0	62.5	79.2
		48	4.2	0	0	0	0	0
		Total....	95.9	100.0	54.2	75.0	62.5	79.2
2. Raw waters devoid of municipal sewage	82	24	25.6	32.9	8.5	21.8	1.8	23.2
		48	43.9	15.8	1.2	1.2	2.4	1.2
		Total....	69.5	48.7	9.7	23.0	4.2	24.4
3. Sum of 1 and 2	106	24	40.6	48.1	18.8	24.5	28.3	35.8
		48	35.0	12.3	.1	.1	.2	.1
		Total....	75.6	60.4	18.9	24.6	28.5	35.9
4. Treated and stored	494	24	7.1	6.3	3.1	3.2	4.6	4.1
		48	40.5	8.1	.8	.4	.8	.2
		Total....	47.6	14.4	3.9	3.6	5.4	4.3
5. Total	600	24	13.0	13.6	5.8	5.3	8.8	9.7
		48	39.5	8.8	.9	.5	1.0	0.2
		Total....	52.5	22.4	6.7	5.8	9.8	9.9

lactose 48-hour gas formers which points to the effect of overgrowths. In the treated water, the presumptive test showed lactose broth to be 33.2 per cent higher than brilliant green, although more of the brilliant green-crystal violet presumptive samples proved positive than did the lactose presumptive samples.

The conclusion is inevitable that in waters known from field survey

actually to contain *Esch. coli*, that brilliant green-crystal violet gives higher presumptive, confirmed, and completed tests than does lactose broth in primary medium. In raw waters devoid of municipal sewage, but containing miscellaneous contamination (but for the most part meeting Treasury Department Standards), brilliant green-crystal violet gives more positive results in 24-hour gas formation than does lactose broth. In waters of the latter type, 48-hour gas formation gives high presumptive lactose test of which a very small percentage proved to be positive for *Esch. coli* and is more nearly the result as determined by brilliant green-crystal violet medium. In treated waters brilliant green-crystal violet medium gives somewhat lower results than lactose broth on the 24-hour gas formation, and in the 48-hour gas formation considerably less. It is also noted that the number of spurious lactose presumptive tests increases between the 24- and 48-hour gas formation period.

CONCLUSIONS

For the past three years lactose broth used as a primary medium produced for the Los Angeles water supply the greatest number of positive 24- and 48-hour presumptive samples in the winter when the greatest contamination was present and when ordinary water bacteria were at a maximum. The 48-hour presumptive samples averaged four times the 24-hour positive presumptive samples and in January when general water bacteria were at their height, the 48-hour count was seven times the 24-hour tests. When segregated according to raw and final waters, the 24-hour presumptive tests for the raw water were at a maximum in the rainy season, whereas in the final waters the maximum was during May and June. The 48-hour presumptive tests for the raw waters were greatest during the late summer and for the final waters during the rainy period. The non-coliform group of the lactose fermenters constituted over 90 per cent of all the 48-hour presumptive lactose samples during January, February, and March. The inference is obvious that lactose broth encourages water bacteria to grow and particularly in the 48-hour presumptive samples, giving the greatest interference with the detection of the coliform group at times when the latter should be at a maximum.

The coliform group, isolated by using lactose broth as a primary medium, was at its maximum from June to October, inclusive. Certainly the fact cannot be lightly set aside that according to *Standard Methods* the maximum contamination for both raw and

final waters occurred during the summer and not during the rainy season. This is contrary to field evidence and all logic. Any primary medium which misses the period of contamination by three months really needs investigation.

Separation of the coli-aerogenes group into *Esch. coli*, doubtful *Esch. coli*, intermediates, and *Aer. aerogenes* indicated that there was absolutely no sanitary significance to be attached to anything but the *Esch. coli* organisms. The 24-hour *Esch. coli* samples for the raw waters were a maximum during February and March, which was logical. The final waters showed some discrepancy with March, May, and June being high. For all samples, the maximum 24-hour *Esch. coli* content was in March. It should be noted that the doubtful *Esch. coli* were greatest during August, the intermediate coliform were highest during September, and *Aer. aerogenes* during August and September, which proves them to be without sanitary significance. There is considerable justification in using *Esch. coli* as differentiated from other coliform members.

There is ample evidence throughout this report that the 48-hour presumptive test is truly a "doubtful" test for the coliform group as stated by *Standard Methods*.

Likewise, the nearer one approached the *Aer. aerogenes* end of the coliform group, the greater was the ratio of 48-hour gas formers. Also, the better the water was, the higher was the ratio of 48-hour gas formers. The 48-hour gas formation was due largely to water organisms devoid of all sanitary significance.

Further deficiency in lactose broth as a primary medium was found in correlating 5,536 samples with ferrocyanide citrate agar. The latter picked up 6 per cent more samples for the coliform group than did lactose broth. Of the positive samples, lactose broth gave higher indices, particularly in the 48-hour bracket. The fact that the 48-hour lactose index was twice the ratio of the 24-hour to the direct method showed that the 48-hour lactose test is greatly in error because the ratio of both the 24- and 48-hour lactose indices to the direct method should be the same. In the samples which lactose broth designated largely as *Aer. aerogenes*, the count was fifteen times higher than that indicated by the direct method as being *Aer. aerogenes* and in the same samples the coliform organisms minus *Aer. aerogenes* were 194 times higher than lactose broth. This indicates how incubation in primary medium can change the ratio of organisms originally present. Also, lactose broth because of this incubation trouble threw 21.5 per cent of the presumptive

lactose samples into the non-coliform group where the direct method for 1,476 samples indicated a coliform count, less *Aer. aerogenes*, of 0.023 per c.c., an *Aer. aerogenes* index of 0.035 per c.c., or a total coliform group of 0.068 per c.c. This proves conclusively that lactose broth instead of being conservative was causing many *Esch. coli* to be missed. The chief objection to the ferrocyanide citrate medium is that it fails to differentiate *Esch. coli* from doubtful *Esch. coli*, and intermediate forms of the coli-aerogenes group.

The new brilliant green-crystal violet medium used for primary inoculation greatly inhibited natural water bacteria and spore formers but without harm to coliform strains and was more productive for *Esch. coli* than was lactose broth. It greatly reduced the 48-hour presumptive tests. While this medium has not yet been perfected, it or any other medium which will give a better index of contamination which will correlate closer with field conditions than is possible with lactose broth is highly desirable.

There is need in the Los Angeles system to make two major changes in the bacteriological procedure before undertaking further refinements. First, primary media starting with brilliant green-crystal violet lactose bile broth should be used in place of lactose broth to inhibit spores and natural water bacteria. This should increase the 24-hour presumptive tests but greatly decrease the 48-hour presumptive tests. Second, the eosine methylene blue procedure should be developed to greater usefulness, particularly when used after a primary medium such as brilliant green-crystal violet. By running control plates with *Esch. coli*, by recording the pH of the eosine methylene blue medium, by reading eosine methylene blue as positive for metallic sheen or wine red bead-like colonies, calling eosine methylene blue negative when growth is non-typical of *Esch. coli* and recording no growth as zero, then definite *Esch. coli* can be readily detected. All negative or questionable plates and all plates when the control plates are negative should be carried again through liquid media for new eosine methylene blue plates. A second negative plate would constitute absence of *Esch. coli*. The positive eosine methylene blue plates would be carried through to the Gram stain to determine morphology and whether Gram negative characteristics.

REFERENCES

1. *Standard Methods of Water Analysis.*, Am. Pub. Health Assoc. and Am. Water Works Assoc., Eighth Ed., 1936.
2. SALLE, A. J. A System of the Bacteriological Examination of Water. J. Bact., **20:** 381 (1930).

WATER FILTRATION PRACTICE IN CANADA

By G. Hudson Strickland

This is a review of information which the Canadian Section has assembled through the medium of the Water Works Information Exchange. This paper will consider the extent and the characteristics of water purification plants in Canada.

A summary of the characteristics of pressure filtration plants in Canada is given in table 1. In order that some comparative data might be available, a summary of replies to questionnaires sent to filtration plants in British Europe (England, Scotland, Wales, Irish Free State) is given as table 2. The major part of this paper will, of course, refer to table 1.

In the Dominion of Canada today we have a total of 1,268 water works systems serving 5,646,692 people. These are arranged by provinces and shown in table 3.

The earliest installation of a public water system is that of St. John, N. B., which dates back to 1838. Three years later the original system of Toronto was inaugurated. Halifax, Nova Scotia is next in order with a water system dating back to 1848 and Montreal's original installations were made in 1857. Windsor, Ontario points with pride to a system that dates from 1872.

Table 4 is a tabulated analysis of the treatment of water in the municipalities included in table 3. It is to be noted that approximately 25 per cent of the population of this country is served with water that has been filtered and chlorinated and that an additional 10 per cent of the people is supplied with a water that is chlorinated only. This information is given by provinces in table 5. The results of these practices are reflected definitely in the typhoid mortality rates of our provinces, and, further, the growth of the number of communities effectively treating their water supplies reflects the favorable attitude of the consumer toward water treatment.

A paper presented at the Canadian Section meeting at Windsor, Ontario, March 25, 1938, by G. Hudson Strickland, Supt., Filtration Plant, Windsor, Ont.

Pressure filtration plants in Canada will be reviewed below under numerous headings.

Source of Supply and Quality of Water. With but one exception, pressure filtration plants use surface waters as the sources of their supplies and the problems encountered include the removal of turbidity and color, taste and odors, and bacteria. No information was sought regarding the quality of the final product for it is assumed that all plants are successful in reducing the quantities of objectionables to acceptable minima.

But are we justified in assuming this or are there plants, the final products of which are not wholly acceptable? If there be such, it is hoped that a study of the comparative figures in tables 1 and 2 will lead to further study of any phase of design or operation which may appear to be contributing to the undesirable conditions.

MAJORITY USE ALUM AND SOLUTION FEED

Pre-treatment and Coagulation. Aluminum sulphate is the most commonly used coagulant. Merriton, Ontario, reports the use of ferric alum. The application of the coagulating chemical in 28 per cent of the plants reporting is by dry feed equipment while 72 per feed the coagulant in solution. Average dosages of alum range from a minimum of 0.25 grains per gallon to a maximum of 3.0 grains per gallon.

Of special interest in the consideration of the pre-treatment accorded the water in the pressure filtration plants is this: Of the 47 plants reviewed, 8 plants do not provide means for mixing the coagulant and the settling out of any portion of the coagulated matter, and the information on file indicates that in several additional instances the mixing and settling periods of the coagulant and the coagulated matter in suspension are negligible. Apparently the application of the chemical in these plants is made directly to the filters. It is not my intention to discuss the merits of this practice.

Where mixing and settling are employed there is a wide range in the time periods. Mixing by mechanical means is reported in 5 plants, by baffles in 13 plants, by action of the pumps in 6 plants, while one system indicates the use of a spiral flow mixing tank. Mixing time periods range from the flash mix of the pump action to a maximum period of 24 hours. Retention periods in settling basins recorded range from a few minutes to five days.

Unquestionably the pre-treatment accorded a water to be filtered

TABLE 1

Pressure Filtration Plants in Canada

PROVINCE	COMMUNITY	POPULATION SERVED			FILTERS														SUPPLY	
									Sand				Gravel			Backwashing				
		In	Out	Total	Date Installed	Number	Shell Size in ft.	Shell Wall Thickness in inches	Depth, inches	Size, mm.	U.C.	Where Obtained	Depth, inches	Layer Sizes, inches	Rate of Flow Control	Frequency	% Wash Water	How Determined[4]	Source	General Quality
Alta.	Edmonton[1]	87,000		87,000	1912, '21, '25, '30	24	17 x 7V[2]	½	30	0.45	1.5	Alberta	18	½ – 1	Manual	24 hr.	3	1	River	Turb., Taste, Col.
	MacLeod[1]	1,500		1,500	1913	4	12 x 18	12	36			Alberta	8		Manual	16 hr.		2	River	Turb., Mt. Stream
Sask.	Assiniboia	1,400		1,400	1926	3	6 x 6½V								Manual	3 per yr.				
	Biggar	2,000		2,000	1930	2	7V	7/16	24	0.40		Cape May	18	1/16 – ½	Manual	24 hr.		1	Deep Wells	Col.
	Estevan	3,000		3,000	1914	2	16 x 8		30			Local	18	#10 – ¼	Manual	6–8 hr.		1	River	Turb.
	Kamsack	2,000		2,000	1914	2	8 x 10		42			Local		None	Manual	48 hr.	1	3	River	Turb., Col.
	Kindersley	1,100		1,100	1912	2			36				8		Manual	24 hr.			Water Shed	Turb.
	Melfort	2,500		2,500	1928	2	8V	½	27			Local	18	½ – 1½	Manual	8 hr.	1–2	1	Water Shed	Turb., Taste
	Melville	3,890		3,890	1930	2	7V	½	27	0.35+		Cape May	12	12–1	Manual	24 hr.		3	Water Shed	Turb., Taste, Col.
	Moose Jaw	20,000		20,000		3	7V	½					12		Manual	24 hr.		3	4 Sources	Turb.
	Prince Albert	11,000		11,000	1910, '23	4	8 x 20		24			Local			Manual		2	1	River	Turb.
Man.	Brandon	17,600		17,600	'93, 1904	4	8 x 20	5/16	42	0.55		Local	14	1/16 – ⅛	Manual	24 hr.	2	1	River	Turb., Col.
	Neepewa	1,500		1,500	1912	2	8 x 8V	7/16	36			Manitoba	8		Manual	2–6 da.			Creek	
Ontario	Arnprior	4,200		4,200	1900	3	22 x 10		25			Cape May	25½		Manual	24 hr.		3	River	Turb., Col.
	Belle River	750	750	1,500	1926, '36	2	16 x 8		27	0.45		Jolliette	12	12–1	Auto.	24 hr.	8	3	Lake	Turb.
	Cardinal	1,500		1,500	1898	2	10 x 8V		18	0.35+		Cape May	36		Auto.	24 hr.			River	Turb.
	Chatham	16,215	300	16,515	'96, 1914	8	20 x 8		30			Red Wing	18		Manual	24 hr.	0.4	1	River	Turb., Taste
	Chippawa	1,195		1,195	1924	1	16 x 7		24			Cape May	24		Manual	16 hr.–7 days	3	1	River	Turb.
	Cobourg	6,000	100	6,100	1913, '35	5	20 x 8		30				18	½ – ¾	Auto.	8–24 hr.		1	Lake	Turb.
	Crystal Beach	10,000	5,000	15,000	1925, '32	3	20 x 8		27	0.40	1.5	Cape May	18	½ – 2½	Auto.	24 hr.	9	3	Lake	Turb.
	Grimsby	2,000	500	2,500	1923	3	20 x 8		24	0.45	1.5	Cape May	18	#3W – ¾	Manual	20 hr.	2	3	Lake	Turb.
	Hailebury	2,720		2,720	1911	5	8 x 6V						36	4	Manual	24 hr.		1	Lake	Turb., Col.
	Kapuskasing	3,351		3,351	1928	2	8 x 25		30			Jolliette	10	#10 – 1	Auto.	48 hr.	1.7	4	River	Turb., Taste, Col.

Ontario	Kingsville	2,367	43	2,410	1926	3	30 x 8	⅛	30						Manual	24 hr.	4	3	Lake	Turb.
	Lindsay	7,000	100	7,100	1917	5	16 x 8	1/16	24	0.45		Cape May	18		Manual	48 hr.	1.7	3	River	Turb., Veg.
	Merriton	2,050	500	2,550	1927	4	20 x 8	⅛	30			Cape May	24		Auto.	24 hr.	4	1	Canal	Turb., Taste
	Napanee	3,000	50	3,050	1930	3	25 x 8	⅛	25			Cape May	12		Manual	24 hr.	5	1	River	Turb., Veg., Col.
	New Toronto	8,286	10,500	18,786	1927, '31	14	20 x 8[3]	⅛	27	0.53	1.6	Ottawa	13, 3	12 - 1[6]	Manual	24 hr.	7.5	1	Lake	Turb., Taste
	Niagara	5,000		5,000	1917	3	17 x 8	⅛				Ohio			Auto.	6 hr.		5	River	Turb., Taste
	Orillia	8,700	300	9,000	1915	5	16 x 8	⅛	18			New Jersey	14		Manual	72 hr.	0.75	4	Lake	Turb., Taste
	Perth	4,183		4,183	1918	2	25 x 8	1/12	30			Cape May	10	Fine to ⅛	Manual	24 hr.		4	River	Turb., Taste
	Picton	3,300	300	3,600	1928	2	20 x 8	⅛	24	0.45	1.65	Cape May	12	12 - 1	Manual	48 hr.		4	Lake	Turb., Taste, Col.
	Port Colborne	8,410	2,600	11,010	1924	4	20 x 8	1/16	27	0.40	1.5+	Cape May	18	2 - ¼		12-24 hr.		1	Canal	Turb., Taste
	Port Stanley	900	to 5,000		1932	2	20 x 8	1/16	28	0.45	1.6	Cape May	28	½ - 1	Manual	24 hr.	1.5	6	Lake	Turb.
	Renfrew	5,343		5,343	'97, 1912, '17	6	6 x 5V[4]	⅛	36			Golden Lake	12	¼ - 1	Manual	3-24 hr.		3	River	Turb.
	Sturgeon Falls	6,000	100	6,100	1931	3	10 x 8	⅛	36			Local	16		Manual	12-24 hr.		1	River	Turb., Col.
	Swastika	700		700	1928	1	6½ x 5V	1/16	18	0.40		Quebec	27	1 mm. - ½	Manual	7-14 da.	2.5	1	River	Turb., Taste, Col.
	Tecumseh	2,200	1,000	3,200	1918, '24, '26	3	8 x 20	1/16							Manual	48 hr.		1	River	Turb.
	Thornbury	820		820	1923	6	5½ x 6V	⅛	36						Manual	4 weeks		3	River	Turb., Col.
	Thorold	5,000	200	5,200	1927	4	23 x 8	⅛	18	0.44	1.45	Cape May	9, 18		Manual	24 hr.	2	3	Canal	Turb.
	Thorold Twp.	2,500		2,500	1928	2	14 x 7	⅛	30	0.44	1.45	Cape May	15		Manual	48 hr.	12.5	3	Canal	Turb.
	Tilbury	2,000		2,000	1931	2	14 x 8									24 hr.			Lake	Turb.
	Wallaceburg	4,665	250	4,915	1915	2	12 x 8	⅛	30	0.59		Cape May	24		Manual	24 hr.			River	Turb., Taste
	Wheatley	750	150	900	1929	1	15 x 8	⅛	27	0.40		Cape May	12	#12 - 1	Auto.	84 hr.		3	Lake	Turb., Taste
Que.	Longueuil	6,200	1,300	7,500	1895	5	8, 16 x 8	1/16	60			New York, White	12	¼ - ¾	Manual	12-24 hr.		1	River	Turb.
	McMasterville	800		800	1916	3	20 x 8	⅛	38				10		Manual	24 hr.	5	1	River	Turb.
	St. Vincent de Paul	2,500		2,500	1923	4	20 x 8	⅛	27	0.40		Cape May	12	#12 - 1	Auto.				River	Turb.

[1] Reported as gravity filtration plants. [2] V denotes a vertical filter. [3] Also has four 16 x 8 ft. filters with ¼-inch shell. [4] Two filters are 25 x 8 ft. [5] Uses anthrafilt. [6] 1 denotes loss of head; 2, action of filters; 3, quality of water; 4, set period; 5, amount pumped; and 6, loss of head and quality of water.

TABLE 1—*Continued*

PROVINCE	COMMUNITY	PRE TREATMENT								IS FLOW METERED	CHLORINATION	TASTE-ODOR CONTROL	FILTERED WATER DELIVERED TO	FILTERED WATER STORAGE IN GAL.	STORAGE, % AV. DAILY DEMAND
		Chemicals Used				Mixing		Settling							
		Kind	Av. Dosage, grains/gal.	Type Feeder	Where Fed	Type	Time Period	Type	Retention Period						
Alta.	Edmonton	Alum	Summer 2.1	Dry	Mixing Chamber	Agitator	30 min.	Pre, Post	1-5½ hr.	No	Pre, Post (seldom)	Act. Carbon	Reservoir	1,500,000	22
	MacLeod	Alum	1.75	Sol.	Entry Subs. Basin	Baffles		Post	3-4 hr.	Yes	Post	None	Reservoir	150,000	45
Sask.	Assiniboia	Alum			Coag. Tank	Baffles					Post	None	Press. Tank	15,000	
	Biggar	Alum	1	Sol.	Filter Inlet	None		None		Yes	Post	None			
	Estevan	Alum	3	Dry	Pump Well	Pump Suction		None		Yes	Pre	Aeration	Reservoir	100,000	57
	Kamsack	Alum		Sol.	Filter Inlet						Pre	None	El. Tank	150,000	120
	Kindersley	Alum[7]		Sol.	Filter Inlet	Mechanical	15 hr.				Pre[8]	None	El. Tank	100,000	300
	Melfort	Alum	1.75	Sol.	Aer. Tank						Pre[8]	Act. Carbon	El. Tank	65,000	80
	Melville	Alum		Sol.	Filter Inlet						Post	Aer., Act. C	El. Tank	100,000	110
	Moose Jaw										Post	None			
	Prince Albert	Alum	1	Sol.	Coag. Basin	Baffles	18-24 hr.				Pre	None	El. Tank	160,000	17
Man.	Brandon	Alum	1.0-2.5	Dry	Entry Coag. Basin					Yes	Pre	None	Reservoir	625,000	60
	Neepewa	Alum		Sol.	Filter Inlet					No	None		Standpipe	156,000	
Ontario	Arnprior	Alum	1	Sol.	Pump Well	Baffles	4 hr.		2 hr.	Yes	Pre	None	El. Tank	95,000	15
	Belle River	Alum	0.75	Dry	Pump Well				10 hr.	No	Pre	None	El. Tank	41,600	24
	Cardinal	None								No	Pre	None		75,000	6
	Chatham	Alum	1.02	Dry	Pump Suction	Pump Action	20 min.	Open Basin	4-5 days	Yes	Pre, Post	Amm. Sulf.	Wells—2	1,100,000	65
	Chippawa	Alum		Sol.	Filter Inlet	Pump Action		1,500 Gal. Well		No	Pre	None	Mains		
	Cobourg	Alum	4,000 lb./yr.	Sol.	Pump Well	Baffles	few min.	1,500 Gal. Well	few min.		Pre	None	El. Tank	300,000	30
	Crystal Beach	Alum	0.25-0.75	Sol.	Pump Well	Baffles	5-10 min.	None		Yes	Pre	None	El. Tank	100,000	15
	Grimsby	Alum	1.5	Sol.	Pump Well	None		Well	45 min.		Post	None	Reservoir	220,000	90
	Hailebury	Alum	2-3	Sol.	Filter Inlet	Mechanical	24 hr.				Pre	Aer. Lime	Reservoir	190,000	76
	Kapuskasing	Alum		Sol.	Mixing Tank	Baffles Air	15 min.	Tank	4 hr.		Pre	None	El. Tank	105,000	37

Ontario	Kingsville	Alum	0.8	Sol.	Pump Well	Mechanical			24 hr.	No	Pre	None	El. Tank	36,000	12
	Lindsay	Alum	1.75	Dry	Mixing Tank	P. Action Rot. Fl. Tank	20 min.	Basin	4 hr.	Yes	Pre	Aer., Act. C	El. Tank	300,000	45
	Merriton	Note[8]	0.75	Sol.	Entry Set. Basin	Baffles	10 min.	Basin	4 hr.	Yes	Pre	Ammonia	Reservoir	5,000,000	500
	Napanee	Alum	2	Dry	Pump Suction	Baffles	5 min.	Basin	½–1½ hr.	Yes	Pre	Act. Carbon	Standpipe	160,000	26
	New Toronto	Alum	0.62	Dry	Entry Coag. Basin	Baffles		Basin	2 hr.	Yes	Pre	Act. Carbon	Mains		
	Niagara	Alum	0.7	Sol.	Intake Screen B.						Pre	None	Reservoir	60,000	24
	Orillia	Alum	0.44	Sol.	⅔ Coag., ⅓ Pump Well	Mechanical		Basin	1 hr.	Yes	Pre	Act. Carbon	Standpipe	725,000	80
	Perth	Alum	1.5	Sol.	Pump Well		flash	None		Yes	Pre	Act. Carbon	Mains		
	Picton	Alum	2	Sol.	Pump Well	Baffles	1 hr.	Basin	3 hr.	Yes	Pre	Act. Carbon	Reservoir	300,000	94
	Port Colborne	Alum	0.28	Dry	Pump Well		3 min.				Pre	Act. Carbon	Mains		
	Port Stanley	Alum	2	Dry	Pump Well	Spiral	40 min.	Basin	2 hr.	Yes	Pre	None	El. Tank	122,500	70
	Renfrew	Alum	2.8	Sol.	Pump Suction	Pump Action		None		Yes	Pre	None		167,000	16
	Sturgeon Falls	None								No	Pre	None	El. Tank	120,000	15
	Swastika	Alum		Sol.	Filter Inlet	None		None		No	Pre	Tried Act. C	Mains		
	Tecumseh	Alum		Sol.	Mixing Tank	Baffles	30 min.				Pre	None	Mains		
	Thornbury	Alum		Sol.	Filter Inlet	Baffles					Pre	None	El. Tank	50,000	55
	Thorold	Alum	0.68	Sol.	Entry Coag. Basin	None		Basin	3–4 da.	Yes	Post	None		34,000	3
	Thorold Twp.	Alum	0.5	Sol.	Entry Coag. Basin		11 min.			No	Pre	None	El. Tank	90,000	94
	Tilbury	Alum		Sol.	Filter Inlet						Pre	None			
	Wallaceburg	Alum		Dry	Entry Coag. Basin		½–1 hr.	Basin	50 min.	No	Pre	Amm. Sulf.	Standpipe	196,000	56
	Wheatley	Alum	2	Dry	Pump Well			Pump Well	15 min.	No	Pre	Amm. Sulf.	El. Tank	35,200	70
Que.	Longueuil	Alum	1	Sol.	Pump Well			Pump Well	15 min.	Yes	Pre	None		85,000	11
	McMasterville	Alum	0.6	Sol.	Pump Suction	Pump Action		None			Pre	None	Mains		
	St. Vincent de Paul	Alum		Sol.							Pre	None			

[7] With soda ash. [8] Ferric alum is used. [9] Instead of liquid chlorine, chlorite of lime is used.

TABLE 2

Characteristics of Pressure Filtration Plants in Great Britain

COMMUNITY	POPULATION SERVED			FILTERS												SUPPLY	
							Sand			Gravel			Backwashing				
	In	Out	Total	Number	Shell Size in feet	Shell Wall Thickness in inches	Depth, inches	Size	Where Obtained	Depth, inches	Layer Sizes inches	Rate of Flow Control	Frequency	% Wash Water	How Determined[5]	Source	General Quality
Alsagar, Stoke-on-Trent	3,000	300	3,300	2	7 x 6½V[5]	⅜–$\frac{5}{16}$		Permutit Green Sand		9	Crushed Flint	Manual	24 hr.				
Bacup, Lancs.	19,614	6,270	25,884	9	8 diam.	$\frac{5}{16}$	42		Leighton, Buzzard		None	Manual	24 hr.	2	2	Moorland	Soft, Peaty
Bacup				2	6 diam.	$\frac{5}{16}$	42		Leighton, Buzzard		None	Manual	24 hr.	2	2	Moorland	Soft, Peaty
Ampthill, Bedford	2,000		2,000	1	11 x 8	$\frac{11}{32}$	6 tons	$\frac{3}{8}$ – $\frac{10}{16}$	Leighton, Buzzard		$\frac{10}{32}$	Manual	7 da.	1.1	1	Bore Holes	
Birkenhead Ches.[1]			145,500	84	8 diam.	$\frac{3}{8}$–½	40	16–40 mesh	Leighton, Buzzard		None	Manual	24 hr.	2	1	Lake Alwen	Soft, Pure
Bournemouth			180,000	48	8 diam.	$\frac{3}{8}$–½	27	20–30 mesh	Leigh., Buzz. Bridport	15	Grit–1½	Manual	2–7 da.	0.7	1	River	Variable, Color
Carlisle, Cumb.[2]	58,000	5,500	63,500	3	8½ x 30	$\frac{7}{16}$	36	Pass 32 mesh	Sea Shore, So. Coast	15	½ – ¾	Auto. Pat. Mod.	48 hr.	1	1	Gathering Ground	Soft, Peaty
Colne, Lancs.[3]	25,000		25,000	3	8 x 4½V[5]	⅜	48	25 mesh	Leigh., Buzz., Bidford	12	Pea–2	Manual Auto.	24 hr.	2	1	Moorland, Bore Hole	Soft, Excellent
Cowdenbeath, Fife Co.	14,000	2,000	16,000	12	8 diam.	½	27	Coarse	Leighton, Buzzard	15	Grit–1½	Manual	24 hr.	3	1	Moorland, Pasture	Soft, Peaty
Glossop, Derby.	6,000		6,000	4	8 diam.	½–⅝	36	20–40 mesh	Denton, Manches.		None	Manual	24 hr.	2	1	Surface Water	Soft
Halifax, York.[4]			221,000	84	9 diam.	⅝	27	½ grade	Leighton, Buzzard	15	$\frac{1}{10}$ – 1½	Manual	48 hr.	1	1	Upland Surface	Soft

Fort William, Inverness.	3,000	500	3,500	3	8 diam.		42		Leighton, Buzzard		None	Auto.	24 hr.	0.5		Mountain Streams	Soft
Lancaster, Lancs.	43,000	27,000	70,000	40	8 diam.	7/16	36	8-16 to 20-40	Leighton, Buzzard		None	Manual	72 hr.	3	1	Moorland	Soft, Peaty
Londonderry, N. Ireland	48,100	1,600	49,700	21	9 diam.	¼	27	10-40 mesh	Leighton, Buzzard	15	Grit-1½	Manual	12 hr.	5	4	Moorland	Soft, Peaty
Macclesfield	36,000	1,000	37,000	4	8 diam.	½	24	Coarse	Leighton, Buzzard		None	Auto.	24 hr.		3	Upland Surface	Very Good
Maryport, Cumb.	14,000	2,000	16,000	4	8½ diam.	1½	38	24-40 mesh	Leighton, Buzzard		None	Auto.	24 hr.	2 2.8	1	River	
Nelson, Lancs.			72,000	16	8 diam.		48		Leighton, Buzzard	22	1/10 - 1	Manual	24 hr.	3.5	1	Moorland	Soft, Peaty
				2	8 x 25		27										
Nottingham	301,361	166,939	468,300	42	8 diam.	1½	36	20-40 mesh	Leighton, Buzzard		Pea Gravel	Partly Manual	24-48 hr.	1.5	5	Sandstone Filt. Supply	Mod. Hard Soft, Color
Oldham, Lancs.	131,000	87,076	218,076	18	9 diam.	½	42		Leighton, Buzzard		None	Manual		1.14	1	Moorland	
Oldham, Lancs.				14	8 diam.	½	42		Leighton, Buzzard		None	Manual		2.59	1	Moorland	
Oldham, Lancs.				3	8 diam.	½	42	4-30 mesh				Auto.		.91	1	Moorland	
Prestatyn, Flint, N. Wales			7,600	6	8 diam.	½	48	App. 1/8	Leighton, Buzzard		¼ - ½	Manual	84 hr.	2	1	Springs in Limestone	18° Hardness
Stratford-upon Avon, Warwick.	15,000	2,000	17,000	2	7 diam.		42	3/32 - 3/4	Leighton, Buzzard	12	¼	Manual	24 hr.	.3 .6		Gath. Gr. Boreholes	
Tunbridge Wells, Kent	45,000	3,200	48,200	6	8½, 8½ diam.		24	1/12 - ½	Leighton, Buzzard	22	½ - 1½	Manual		0.13	1	Deep Well	Soft
				6	25 x 8-6″		8	Polarite									
Wakefield, York	60,000	100,000	160,000	5	8 x 30		2 30	20-30 mesh	Sea Sand Poole Dors.	12	¼ - ½	Auto.	24-72 hr.	1	1	Moorland	Soft, Peaty

[1] Revolving rakes used in backwash. Post-treatment of Lime. [2] Slow sand filters used in addition. Pressure filters operate at constant rate. [3] Sand (48 in.) only in No. 1 battery. Sand and gravel in No. 2 battery. [4] Patent air agitating process used. [5] V denotes a vertical filter. [6] 1 denotes loss of head; 2, time interval; 3, quality of water; 4, loss of head and quality of water; and 5, loss of head and color of effluent.

TABLE 2—*Continued*

COMMUNITY	PRE TREATMENT								IS FLOW METERED	CHLORINATION	TASTE-ODOR CONTROL	FILTERED WATER DELIVERED TO	FILTERED WATER STORAGE IN GAL.	STORAGE, % AV. DAILY DEMAND
	Chemicals Used				Mixing		Settling							
	Kind	Av. Dosage, grains/gal.	Type Feeder	Where Fed	Type	Time Period	Type	Retention Period						
Alsagar, Stoke-on-Trent														
Bacup, Lancs.	None									None	None	Mains		
Bacup	None									None	None	Mains		
Ampthill, Bedford	Hyd. Lime	2,700 lb. m.g.		Before Sett. Tk.	Baffles	5 sec.	Tank	12 hr.	Yes	None	None	Reser.	200,000	200
Birkenhead Ches.	Alum, Chalk	1.6 1.6	Sol. Susp.	Raw Water, Main to Filt.		20–40 sec.	None		Yes	None	None	Reser.	38,000,000	550
Bournemouth	Alfloc, Alum	5 p.p.m.	Dry Sol.		Pumps, Paddles	30 min.	Open Tank Baff. Tank	6 hr.	Yes	Post Chloramine		Reser.	10,000,000	200
Carlisle, Cumb.	Alum	1	Sol.	Filter Inlet	Baffles	few min.	None after Adding Coagulant		No	None	None	Reser.	220,000	6
Colne, Lancs.	Alum	2	Sol.	Filter Inlet					Yes	None	None	Reser.	5,000,000	800
Cowdenbeath, Fife Co.	Alum	0.25	Sol.	Filter Inlet	Pump	1–3 min.	None after Adding Coagulant		Yes	None	None	Reser.	800,000	100
Glossop, Derby.	Alum	0.5	Sol.	Filter Inlet	Turbine		None after Adding Coagulant		Yes	None	None	Mains		
Halifax, York.	Alum, Lime	1 0.33	Sol. Sol.	Filter Inlet	In Pipe	15 min.	None after Adding Coagulant		Yes	None	None	Mains		

Fort William, Inverness.	Alum		Sol.		Turbine			No	None	None	Reser.	750,000	250
Lancaster, Lancs.	Fe Alum, Chalk	1	Sol.	Filter Inlet			None after Adding Coagulant	Yes	None	None	Reser.	1,250,000	30
Londonderry, N. Ireland	Alum	1.35-2.1	Sol.	Filter Inlet	50-foot Main		None after Adding Coagulant	Yes	None	None	Reser.	67,000,000	2,500
Macclesfield	Ferric Alum	0.2	Sol.		Pump			Yes	Post	None	Reser.	2,000,000	160
Maryport, Cumb.	Alum	1	Sol.	Pump Suction	Pump		None	Yes	Pre	None	Reser.	1,495,000	300
Nelson, Lancs.	Chalk	0.75 1.0	Sol.	Filter Inlet		1 min.	None	Yes	Post Chloram.	None	Reser.	7,000,000	350
Nottingham	Ferric Alum	0.9	Sol.	Filter Inlet	None		None	Yes	None	None			
Oldham, Lancs.	Fe Alum, Car. Lime	0.13 1.6		Filter Inlet	None		None	Yes	None	None	Mains		
Oldham, Lancs.	Fe Alum, Hyd. Lime	0.14 0.74		Filter Inlet	None		None	Yes	None	None	Reser.	368,000,000	
Oldham, Lancs.	Soda Ash	1.34		Filter Inlet	None		None	Yes	None	None		140,000	
Prestatyn, Flint. N. Wales	Alum	1	Sol.	Filter Inlet	None		None	Yes	None	None	Mains		
Stratford-upon Avon, Warwick.	Ferric Alum		Sol.		Mech.	15 min.		Yes	Pre	None	Reser.	100,000	
Tunbridge Wells, Kent	Ferric Alum	½-½	Sol. Batch	Filter Inlet	None		None	Est.	None	None	Mains		
Wakefield, York	Alum	0.25	Sol.	Filter Inlet	Pump		None	Yes	Post	None	Reser.	1,250,000	30

has a direct bearing upon the quality of the effluent of the filter, and it is unreasonable to expect a filter to handle an unconditioned water in the same satisfactory manner that it can accommodate a well conditioned applied water.

Finely divided particles of suspended matter, whether they be classed as color or turbidity, are most satisfactorily removed when the coagulating chemical has been mixed intimately in chambers which permit the building up of substantial floc particles and when this mixture of floc and suspended matter and water is passed through a settling basin where much of the matter in suspension may be precipitated.

TABLE 3

Summary of Water Works Service in Canada

PROVINCES	APPROX. TOTAL POPULATION	NUMBER OF SYSTEMS	POPULATION SERVED	% TOTAL POPULATION SERVED
British Columbia	750,000	128	482,415	64
Alberta	772,000	40	222,950	29
Saskatchewan	931,000	33	181,200	20
Manitoba	711,000	14	283,100	40
Ontario	3,690,000	288	2,231,680	60
Quebec	3,069,000	691	1,864,427	61
New Brunswick	425,000	28	132,170	30
Nova Scotia	513,000	44	32,000	45.2
Prince Edward Island	92,000	2	16,200	18
Total	10,963,000	1,268	5,646,692	52

Filters, Sand and Gravel. The majority of pressure filters in use in Canada are of horizontal construction; comparatively few (13) are of the vertical type. The most common diameter of the horizontal is 8 feet while lengths range from 10 feet to 30 feet.

There appears to be a wide range in types of sands used in pressure filters. Several installations report the use of a local sand while many use well known commercial brands. The depths of the sand layers reported range from 18 to 60 inches, while the average grain size of 0.45 m.m. is most popular. Gravel ranges in depth from 8 to 36 inches with layer sizes from $1\frac{1}{2}$ inches to fine gravel or coarse sand. One plant reports the use of a layer of Anthrafilt in the gravel.

In the information reported in the Exchange and from the replies

TABLE 4

Analysis of Kinds of Treatment by Provinces

PROVINCE	MUNICIPAL WATER SYSTEMS	SYSTEMS WITHOUT TREATMENT	SYSTEMS AND TREATMENT	% POPULATION SERVED TREATED WATER
British Columbia	128	127	1 Chlorination (part time)	0.15
Alberta	40	30	7 Filtration & Chlor. 3 Chlorination	23. 1.
Saskatchewan	33	17	1 Filtration only 10 Filtration & Chlor. 5 Chlorination	0.2 10. 7.
Manitoba	14	4	1 Filtration only 4 Filtration & Chlor. 5 Chlorination	0.4 4. 34.
Ontario	288	152	5 Infiltration 60 Filtration & Chlor. 69 Chlorination 2 Softening & Iron Removal	 37. 12. 0.5
Quebec	691	607	5 Filtration only 40 Filtration & Chlor. 38 Chlorination 1 Filtration & Ultra Violet Rays	0.1 34. 9.
New Brunswick	28	21	2 Filtration & Chlor. 5 Chlorination	3. 19.
Nova Scotia	44	34	6 Chlorination 1 Chlor. plus Aux. Hypochlorite 1 Hypochlorite 1 Slow Sand Filters 1 Slow Sand Filters plus Hypochlorite	
Prince Edward Is.	2	2	Nil	Nil

Summary—Dominion of Canada

Total Population	10,963,000
Total Water Works Systems	1,268
Systems without treatment	994
Systems:	
Filtration only	7
Filtration & Chlorination	123
Chlorination only	132
Filtration & Ultra Violet Rays	1
Softening & Iron Removal	2
Infiltration	5
Misc. and combination (See Nova Scotia above)	4
Total	274

to additional questionnaires sent to pressure filtration plants in Canada it appears that full information regarding the filter layer is not readily at hand in a number of plants. This is to be regretted. Those who operate these plants and who have not the information on file should take immediate steps to complete the record of this important part of the system.

Filter Backwashing. In most instances the frequency of filter backwashing is determined by the amount of head lost in passing the water through the filters. Some plants report the frequency of this operation established by the condition of the effluent from the filter, while in a few cases backwashing is at regular fixed time intervals. Detailed information regarding the technique employed to clean the

TABLE 5

Population Served

	FILTRATION & CHLOR.	CHLORINATION
British Columbia		5,000
Alberta	180,100	7,300
Saskatchewan	90,500	64,100
Manitoba	28,100	244,900
Ontario	1,373,280	425,895
Quebec	1,048,325	278,025
New Brunswick	12,200	79,100
Nova Scotia	35,150	87,000
Prince Edward Island		
Total	2,767,655 (25%)	1,191,320 (10%)

filters is not available but it may be noted that no plants report the use of air in the backwashing process. The percentages of water used for this purpose range from less than 1 per cent to 12.5 per cent.

Control Mechanism. A satisfactory interpretation of the replies to the question "Is rate of filtration controlled automatically, manually or by demand of community for water?" is not possible from the answers received. It is evident that in a number of plants, some of which report filter water storage, this rate is changed manually and not automatically. It is the opinion of the writer that automatic control is the more desirable as it prevents water from passing through the filter at rates beyond the safe capacity of the particular filter in service.

There is a maximum safe rate of filtration for every filter, and to

produce water at a rate in excess of this is to invite an effluent of inferior quality. This rate may be set theoretically at 125 million gallons per acre per day or it may be determined by repeated tests made at the filter. It is not sound practice to permit a filter to "run wild" and pass water at rates beyond its established maximum efficient rate of filtration. Equipment to control this rate is available and its use is recommended.

There is a definite indication in the data on file that metering of the water as it passes to or from the filters is not practiced in a number of systems. Meters are an important part of control mechanism and when available may be used to check filter rates and to determine accurately the quantities of chemicals to be applied.

TABLE 6

Provincial Chlorine Residual Requirements

British Columbia—One chlorinating plant only, no provincial regulation
Alberta—0.1-0.2 p.p.m. after 10 minutes contact
Saskatchewan—Average approx. 0.1 p.p.m., no provincial regulation
Manitoba—0.1-0.2 p.p.m. after 10 minutes contact
Ontario—0.1-0.2 p.p.m. after 10 minutes contact
Quebec—0.1-0.2 p.p.m. after 5 minutes contact (Winter)
after 10 minutes contact (Summer)
New Brunswick—0.5 p.p.m. (District Health Regulations)
Nova Scotia—0.15 p.p.m. after 15 minutes contact
Prince Edward Island—(No Reply)

Chlorination, Taste and Odor Control. With one exception all pressure filtration plants report chlorination of their supplies. Thirty-seven of these plants report the application of chlorine before filtration while six add the sterilizing agent after filtration. Two plants report the application of chlorine both before and after filtration. It is assumed that the quantities applied are sufficient to meet the natural demands of the water and to permit a residual sufficient to satisfy the requirements of the local and provincial departments of health. Table 6 shows the requirements of the various provincial Departments of Health.

The average consumer of water has become taste conscious. This may be a hackneyed phrase but it may be accepted as fact. To meet the demands of the average consumers, domestic and industrial, taste and odor control measures are being applied in an increasing number of plants. The methods employed include aeration, the

chloramine process and the use of activated carbon, and in each instance the treatment applied appears to have reduced the objectionable taste or odor to an acceptable minimum. It will be interesting to note the further growth of this phase of water purification.

MECHANICAL GRAVITY FILTRATION PLANTS

The Water Works Information Exchange lists 67 municipal mechanical gravity filtration plants in Canada serving a total population of approximately 2,430,000 or 22 per cent of the total population of this country. Listing by provinces, we find that British Columbia has no plants; that Alberta has 6 serving 190,000; Saskatchewan has 1 serving 46,000; Manitoba has 1 serving 4,000; Ontario has 23 serving 1,425,000; Quebec has 35 serving 1,750,000; New Brunswick has 1 serving 9,000; and that Nova Scotia and Prince Edward Island have no plants. Two additional plants were placed in service in Manitoba in 1937.

The rated capacities of these plants range from a minimum of 185,000 gallons to a maximum of 150 million gallons per 24 hours. Fifteen plants have capacities of less than one million gallons daily.

The largest mechanical gravity filtration plants are given in table 7. Surface waters from lakes, bays, rivers and creeks represent the sources from which these plants secure their supplies of water and the problems encountered in the production of a satisfactory effluent include the removal of suspended matter (turbidity), color, tastes, and odors and potentially hazardous bacterial life.

PRE-TREATMENT

In the preparation of the raw water for application to the filters, aluminum sulphate (filter alum) is the most commonly employed coagulating chemical. Montreal, the largest filtration plant in Canada, reports that it does not use a coagulant but applies the raw water to the filters without pre-treatment. The use of ferrous sulphate and lime is reported in one installation only, while six plants indicate the use of lime in conjunction with filter alum and one plant uses aluminoferric as a coagulant.

Appreciating the many problems which may be encountered in coagulating and settling suspended matter due to the many types and varying quantities of turbidity which may appear in the raw water, the following figures are given merely as a record of average dosages of chemicals applied in 1935. In no way may they be ac-

cepted as a reflection on the operating efficiencies of the filtration plants. The maximum average dosage of alum applied is reported by Camrose, Alberta, with an average dosage of 7.0 grains per gallon. The next highest average dosage is reported by Iroquois Falls, Ontario, with 6.1 g.p.g., while five plants report average dosages between 3 and 4 g.p.g. The lowest application of alum is reported by Hamilton, Ontario, with an average charge of 0.076 g.p.g. In all, 18 plants report average dosages of alum of less than 1 g.p.g.

Dosages of lime range from 0.5 to 2.4 g.p.g. with lime/alum ratios of 1/1 to 1/3. Soda ash dosages in the 3 plants reporting range from 0.94 to 3.6 g.p.g.

The record of choice of equipment used to apply these chemicals shows that 42 (approx. 60 per cent) of the filtration plants employ solution feed devices while the remainder feed the chemicals in dry

TABLE 7

Large Mechanical Gravity Filtration Plants

	CAPACITY IN M.G.D.	POPULATION SERVED
Montreal, Quebec	150	1,325,000
Toronto, Ontario	60*	728,000
Hamilton, Ontario	40	159,000
Ottawa, Ontario	35	155,000
Calgary, Alberta	28	83,000
Windsor, Ontario	21	118,000

* Capacity of drifting sand filters only.

form. The size of the filtration plant may not be accepted as an indication of the type of equipment used.

The intimate mixing of the coagulating chemical is practiced in all but 4 of the 67 plants considered in this review. Of the 4 plants so reporting, 1 does not employ a coagulant, 2 indicate that the water enters the coagulation basins immediately after the application of the chemical, and complete information is not available regarding the practice in the remaining plant. In general, mixing is common practice in Canada and the methods employed include the following: baffled chamber mixing in 27 plants, spiral flow mixing in 10, mechanical mixing in 8, pump action mixing in 3, pipe line mixing in 2, and "aero mix" in one plant. The remaining plants have not reported their particular method in the mixing practice.

Mixing time periods range from the flash mix of the pumps, a

matter of seconds, to a maximum of 48 hours of mechanical mixing. (The latter instance is followed by 8 hours retention in the settling basins.) There is little uniformity in the mixing time periods reported.

In the seven plants reporting flow velocities in the mixing chambers, the average velocities range from 0.05 to 5.0 feet per second. Five of the seven plants report uniform velocities throughout the mixing chambers while two indicate decreased velocities of 25 and 50 per cent respectively at the discharge end of the chambers. Head losses in the mixing chambers (plants reporting) range from $4\frac{1}{8}$ inches to $2\frac{1}{2}$ feet.

Coagulation and Settling. The settling of the matter in suspension following the mixing of the coagulating chemical is common practice in Canada. The periods of retention range from 28 minutes to 12 hours while the majority of the plants reviewed report settling periods of from 2 to 3 hours.

FLOW VELOCITIES RANGE FROM 0.24 TO 3.0 FEET PER MINUTE

Of the 13 plants reporting, 10 indicate the use of devices to still and direct the flow of water entering the settling basins. Three plants report no control of the water as it enters these basins. These devices include baffle walls with and without openings or slots, and overflow weirs. Average flow velocities in 9 of the 13 plants reviewed range from 0.24 to 3.0 feet per minute.

The flow of water in the settling basins in 7 of the 13 plants is reported as "end to end" while the remaining 6 plants indicate "around the end" flow. The average removal of suspended matter in the settling basins ranges from 50 to 96 per cent with maximum average applied water turbidities of 20 to 25 p.p.m.

Flow velocities in the conduits leading from the settling basins to the filters range from 0.13 to 4.0 feet per second while the velocities of the waters entering the filters range from 0.5 to 4.26 feet per second. In all plants reporting the flow velocity of the water entering the filters is appreciably greater than in the settled water conduit.

Filter Layers. Individual or single layer areas range from the 1,456 sq. ft. units at Calgary, Alberta, and Ottawa to 37 sq. ft. units at Gatineau, Quebec. In the six largest plants the areas shown in table 8 are found.

The sand layers range in depth from 18 to 54 inches (Toronto drifting sand filter, 108 in.) with the majority of plants recording

from 24 to 30 inches. Sand sizes, as effective sizes, in general are from 0.40 to 0.50 mm., with uniformity coefficients from 1.3 to 1.7. Local sands were used in 3 of the filtration plants in Western Canada while the remainder of the plants reporting indicate the use of well known standard brands of sand.

Gravel layers range in thickness from 8 to 27 inches with 3, 4, 5 and 6 sizes of stone used to build up this support for the sand mat. The largest stone size used is 2½ in. while the finer gravels range down to #16 mesh. Windsor, Ontario uses a 6-inch layer of ½-inch pebbles washed in cement grout, and carefully laid to prevent clogging, as part of its 15-inch gravel layer.

Filter underdrains, with one exception are of standard manifold and lateral design. Burlington, Ontario employs the Wagner bottom as the underdrain to the filter. The materials used in the construc-

TABLE 8

Areas of Filter Layers in Largest Plants

	NO. FILTER LAYERS	DIMENSIONS IN FEET	AREA SQ. FT.
Montreal, Quebec	48	50 x 24	1200
Toronto, Ontario	(See Drifting Sand Filters)		
Hamilton, Ontario	12	45 x 32	1440
Ottawa, Ontario	10	56 x 26	1456
Calgary, Alberta	8	56 x 26	1456
Windsor, Ontario	10	28 x 25	700

tion of the underdrains include cast iron, wrought iron, steel, brass, copper and sherardized metal. Cast iron is the most commonly employed metal with brass and wrought iron next in favor. There is one installation each of copper, steel and sherardized metal.

Orifices in the laterals and manifolds range from standard drilled holes to bronze strainers, mushroom type strainers and brass and bronze bushed openings. The opening sizes range from ¾ to $\frac{3}{16}$ inch.

Filter trough materials include cast iron, concrete, wrought iron and steel; cast iron is the most commonly employed material. Fifteen of the 24 plants reporting trough dimensions in detail indicate uniform cross sectional areas while 9 plants report increased cross sectional areas in the discharge ends of the troughs. These increases range from 100 per cent to 12 per cent of the minimum area.

Filter backwashing, that process in the operation of a filtration plant that has much bearing on the general condition of the sand, as

practiced in Canada represents a most interesting study. The average frequencies of backwashing or lengths of filter runs range from a minimum of 4 hours (Donnaconna, Quebec) and 8–10 hours as reported by Hawkesbury, Ontario, to a maximum average run of 97.5 hours at Ottawa.

For comparative purposes it is suggested that filter performances be expressed in terms of "average gallons filtered per sq. ft. of sand per 1-foot loss of head." This would compensate for varying rates of filtration and sizes of filter units, and would not lower the efficiency index of those plants which for one reason or another take filters out of service before they have reached their maximum available working loss of head. This has been practiced in Windsor for several years and it is felt that the records obtained give a true indication of the relative performances of the filters.

Filter wash water rates reported as "rise of wash water in inches per minute" range from a 13-inch rise to a 40-inch rise. No records of the relative sand expansion during the backwashing are available at this time. Of the 50 plants reporting information as to the source of filter backwashing water, 17 indicate the use of separate wash water tanks while the remainder indicate taking the supply from the system or having separate pumping units to produce the necessary pressures.

The use of air in the backwashing process is reported by 27 plants of which 24 are in the province of Quebec. Calgary, Alberta reports the use of high pressure hose and rakes during the winter months.

Windsor introduced the following backwashing schedule early in 1937 with most satisfactory results: 15 seconds, primary expansion to one-half full expansion; 4 minutes, one-half full expansion (10-inch rise); 15 seconds, secondary expansion; and 4 to 5 minutes, full expansion (18-inch rise). This backwashing permits adequate scrubbing of the sand grains and fine mud accretions which normally form on the top of the sand at Windsor and the removal of all broken down floc and "dirt" particles.

The amount of wash water used to maintain the filters in reasonably clean condition ranges from 1 to 10 per cent of the total gallons filtered. The 6 largest plants report wash water consumption from 1.21 per cent (Toronto) to 2.98 per cent (Hamilton). The length of time required to backwash a single filter ranges from 3 to 25 minutes. Burlington, Ontario reports the use of an automatic rate of flow controller in the backwashing process.

DRIFTING SAND FILTERS AT TORONTO

Of special interest in this review of mechanical gravity filtration plants is a study of the drifting sand filters employed as part of the Toronto, Ontario system. The following is a brief general description by Norman J. Howard, director water purification, Toronto, Ontario.

"The multiple filter unit system as adopted in Toronto consists of ten units, each having a nominal capacity of 6 million gallons. Each filter is made of steel, is 14 ft. high, 50 ft. in diameter, and is divided into thirty smaller units. These units are nested together in two rings of 18 and 12 respectively. In the centre of the filter is a space 16 ft. 8 in. in diameter, in which is placed the raw water control balance. Each of the thirty units forms a separate quadrilateral unit with sand extractors, sand washer and filtered water collecting system. For backwashing, an overflow channel 15 in. wide and approximately 3 ft. deep is placed around the outer ring.

"At the bottom of each filter, partly embedded in the concrete, is a cast-iron collector pipe for the filtered water. Running out from the collecting pipe is a series of $1\frac{1}{2}$-inch wrought iron sherardized pipes, having $\frac{3}{8}$-inch holes drilled on the underside, spaced about 6 in. apart. These pipes have a cap on the outer end and the inner end is screwed into the cast-iron collector. On the top of the pipes is rounded gravel in three grades, varying from $\frac{3}{4}$ to $\frac{3}{16}$ in., to a depth of 10 in., and above this is 9 feet of sand. The total amount of sand in each filter is 600 cubic yards. No screens are used between the gravel and the sand. The sand has an average effective size of .375 mm., and a uniformity coefficient of 1.6 to 2.

"Around each small unit is a system of slots, and the drifting sand is withdrawn from the filter by means of extractor pipes through which the sand flows to the bottom of the filter unit into a sand washer. At the sand washer the sand falls to the bottom through a current of raw water and is thus cleaned. It is picked up by the incoming raw water and carried back to the filter. The dirty water impurities or suspended matter pass upward and out at the top of the sand washer by an outlet suitably controlled. A water jet is provided to assist the flow of sand through the extractor pipes, and, below the point of discharge, a glass inspection port is provided, so that the flow of sand from each extractor pipe can be observed. The sand washers are of cast iron. The throats are relined when occasion arises, with wrought-iron pipe liners, specially hardened by

a carbonizing process. The liners are in three steps and are 13½ in. high.

"The plant was designed by the late William Gore and is operating efficiently. For water having turbidity up to 200 parts per million the drifting sand system will work well. Algal growths do not bother the filters at all. The drifting sand filters have demonstrated their ability to handle high turbidities for limited periods. Moderate turbidities can be handled indefinitely. If, however, turbidity exceeds 300 parts per million for prolonged periods some will pass the filters."

Individual filter rate controllers to maintain uniform rates of filtration during the filter runs are used in all plants. Ottawa employs a master rate controller in addition to the individual units and Toronto reports controllers on both inlet and outlet lines to the filters. Windsor uses one controller only to two beds with satisfactory results. All rate controllers are of standard well known designs.

Average rates of filtration (1937 reports) range from 63 m.g. to 289 m.g. per acre per day, while maximum rates employed range from 110 m.g. to 424 m.g. per acre per day. Average working loss of head, the average difference between the initial and final loss of head readings, ranges from 1.4 to 8 feet.

CHLORINATION IS GENERAL

Chlorination of the water in mechanical gravity filter plants is general in Canada. Fifty of the 67 plants report the chlorine application made *after* filtration while 11 plants report chlorination *before* and *after* filtration. In the remaining plants chlorine is applied *before* filtration. Average dosages range from 0.11 to 3.0 p.p.m. and are sufficient to meet the normal demands of these waters and to maintain residuals acceptable to the health authorities.

Taste and odor control measures are reported by 16 mechanical gravity plants in Canada and the methods employed include the chloramine treatment, the use of activated carbon, super- and dechlorination and aeration. Some plants report these measures as intermittent and used only when the tastes and odors become appreciably objectionable.

This review is presented without comment as to the merit of any particular system or process. It is hoped that it will be of interest to the operators of filtration plants and will create sufficient interest

to encourage these operators to continue the study of the characteristics of their particular plants.

DATA GATHERED BY INFORMATION EXCHANGE

It is the intention, also, of this paper to draw attention to the Water Works Information Exchange, a feature publication of the Canadian Section of the American Water Works Association, from which most of the data given in this review were obtained. A review of the characteristics of the slow sand filtration plants, of which there are 11 reported in Canada, is being made by the Water Works Information Exchange. Costs of construction and operation have not been discussed because it was felt that the information available at this time was not sufficiently complete to permit a careful study of that phase.

Special acknowledgment is made to the many directors of water purification plants in British Europe (England, Scotland, Wales, Ireland) for information, so kindly promptly sent, in reply to questionnaires sent to them requesting data of their filtration plants.

MATHEMATICS OF WATER TREATMENT

By R. Hulbert

Our profession has its share of knotty little business problems cropping up in the course of every-day work. As rugged individualists, we usually proceed to solve these in our own time and way, without benefit of text book or formula. We know from experience that our own pet system of figuring things out really works, and are skeptical about changing. So, far from proposing any mathematical New Deal for you professionals, this paper merely tries to explain simply the solution of a few ordinary, elementary kinds of water purification problems for the beginner's benefit.

Our common types of treatment plant problems are concerned with all kinds of size measurements, dealing with proportions, equivalents and relations between weights, volumes, concentrations, densities, etc. Since the every-day language of size is mathematics, one is obliged to understand and use it for making constant comparisons of how much, how little, and how big. Problems involving figures and arithmetic are said to be the best test of intelligence; at any rate, the ability to juggle figures intelligently and correctly is quite important in every stage of the water purification process. A good memory is also rather important, since it enables one always to have ready at hand all those old-fashioned tables of weights and measure once learned back in grammar school under protest. These are essential now, because they inventory all the numerous, different units by which we are wont to express how much, how big, how little, etc.

Three different, but related units are common passwords in water purification; they are: parts per million, grains per gallon, and pounds per million gallons. A discussion of their usage, relationship, and respective merits makes a good beginning, and shows the possibilities of applying rule one in mathematics, which says 'to simplify, collect terms and cancel out.'

A paper presented before the Michigan Conference on Water Purification at joint meeting with the Michigan Section at Saginaw, Mich., Sept. 16, 1938, by R. Hulbert, Asst. Supt. of Filtration, Detroit.

The term "parts per million" will be the first considered. The results of water laboratory and filter plant operation in Michigan are now reported uniformly in parts per million, wherever possible. This unit is the best and most useful in our vocabulary, expressing, as it does, simply parts of one thing contained in a million parts of another, both by weight, unless otherwise stated. The impurities in water are present in extremely low concentration, so that when measured in terms of p.p.m. the figure generally turns out to be a small number. If the parts of impurity or ingredient are measured in pounds, then the million parts of water represent a million pounds. Thus 10 lb. of salt per million lb. of water, or 10 grams of it per million grams of water, or 10 grains per million grains, all indicate the same concentration, viz., 10 p.p.m. As a pure weight-for-weight unit, p.p.m. is equally applicable to any system of weights and measure, whether avoirdupois, metric, troy, or what not. This is not true of the other units commonly employed.

Another fact in connection with p.p.m. gives it preference in the water laboratory: p.p.m. is equivalent to milligrams per liter of water. This is true because a liter of water (1,000 c.c. at 0 deg. C. and 760 mm.) weighs 1 million milligrams. In analytical work, the water chemist starts with an exact fraction (aliquot portion) of a liter volume for test purposes and determines weight of impurity sought in milligrams. Then to obtain the concentration of the latter, he merely multiplies milligrams of ingredient found by the reciprocal of the fraction of a liter taken as a sample, and the result is in terms of milligrams per liter, or p.p.m.

Grains per gallon is a hybrid term, half-brother to p.p.m., and one that is strictly superfluous to the filter man who is sensible enough to think in terms of p.p.m. exclusively. Grains per gallon means exactly what it says, grains of something contained in a gallon of water. It is a hybrid because it expresses weight per volume, and not weight for weight.

Since a gallon of water weighs 58,349 grains, one g.p.g. is equivalent to one part in 58,349 parts, or to 1,000,000 divided by 58,349 equals 17.1 p.p.m. Therefore multiply g.p.g. by 17.1 for equivalent p.p.m., or conversely divide p.p.m. by 17.1 to obtain g.p.g. The term grains per gallon is still used a good deal in boiler water chemistry and treatment in preference to p.p.m., because an illusion seems to persist that it is more readily understood by those not familiar with chemical terms. However, good advice to the beginner in water

filtration would be to cancel out g.p.g. and substitute 17.1 times its value. In other words use p.p.m. instead.

Pounds per million gallons is a second poor-relative of p.p.m., but unfortunately one not so easily ignored as g.p.g. By force of habit one thinks of a quantity of water in terms of gallons, and water meters usually read in either gallons or cubic feet, never in pounds. Consequently, any chemical dose figured in the laboratory in terms of p.p.m. must be converted into terms of pounds per million gallons by using a multiplication factor, let us say, for the benefit of the alum-man working in the plant. Now, if the water flow rate was only metered in pounds, then very conveniently pounds of chemical required to dose so many metered pounds of water would correspond to p.p.m. This would avoid conversion of gallons to pounds, and obviate the necessity of carrying around another yardstick graduated in two different units.

Having to put up with both units, p.p.m. and lb./m.g., leads to the necessity of remembering two more conversion factors. Knowing that a gallon of water weighs 8.33 lb., the relation between the two units is worked out by some such process of reasoning as this:

> One p.p.m. = 1 lb. per million lb. = 8.33 lb. per 8.33 million lb. Since 8.33 million lb. water = 1 million gallons, then by substituting 1 m.g. for its equal 8.33 million lb., observe that 1 p.p.m. = 8.33 lb. per 1 million gallons. Or, 1 lb. per m.g. = $\frac{1}{8.33}$ p.p.m., or 0.12 p.p.m.

Dosage according to rate of flow, or the apportionment and checking of chemical feed involves the rate of passage of water through the plant, or quantity per given time. For example, chlorine feeders are calibrated in pounds per day; hence to regulate the gas feed in terms of p.p.m., one must know the water flow rate in terms of gallons per day, or other time interval. Given a water rate of 6.0 m.g.d. and a chemical feed of 0.84 p.p.m., the usual problem is to determine pounds of chemical to be fed per hour, thus:

> 0.84 p.p.m. × 8.33 lb. per gal. = 7.0 lb. per m.g.
> 7.0 lb./m.g. × 6.0 m.g.d. = 42 lb. chlorine per day.
> 42.0 lb./day divided by 24 hr. per day = 1.75 lb. per hour dosing rate.

Errors in chemical feeders are usually reported as plus or minus per cent. Chlorine gas fed per hour is checked by noting tank loss-of-weight on a platform scale. If it falls short of the above calculated

dose by one ounce per hour, for instance, then the percentage error is figured:

$$\frac{\text{actual feed} - \text{calculated feed} \times 100}{\text{calculated feed}} = \frac{1.6875 - 1.75 \times 100}{1.75}$$

$$= \frac{-0.0625 \times 100}{1.75} = -3.57\% \text{ error (in actual feed)}$$

Frequently (again for the benefit of the alum-man out in the plant) the chemist has to specify the chemicals to be added in terms of pounds and ounces per given time. Assume that it is desired to regulate alum feed at 2.5 p.p.m. with rate-of-flow at 3.0 m.g.d. The problem is to figure how many ounces of alum the dry-feed machine should deliver every five minutes to give this specified dose. The reasoning is the same as in the problem given for chlorine above, with two extra multiplication steps, and division of the day into 1,440 minutes, instead of 24 hours. Step by step, the solution is as follows:

(a)

2.5 p.p.m. × 8.33 lb. per gal.	= 20.8 lb./m.g.
20.8 lb./m.g. × 3.0 m.g.d.	= 62.5 lb./day
62.5 lb./day × 16 oz./lb.	= 1,000 oz./day
1,000 oz./day ÷ 1,440 min./day	= 0.70 oz./min.
0.7 oz./min. × 5 min.	= 3.5 oz./5 min.

A slide rule will save paper work, or one may set the problem up in fractional form, cancel out, and obtain the answer quickly; thus:

(b)
$$\frac{2.5 \times 8.33 \times 3.0 \times 16 \times 5}{1440} = 2.5 \times 1.39 = 3.47 \text{ oz./5 min.}$$

(1.39 = 90 / 18 / 6)

Only two variables appear in this problem, enabling one to set it up in a manner similar to the above, cancel out, and solve to obtain a factor that will be useful for future calculations, thus:

(c)
$$\frac{\text{p.p.m.} \times 8.33 \times \text{m.g.d.} \times 16 \times 5}{1440} = \text{p.p.m.} \times \text{m.g.d.} \times 0.463$$

= oz. per 5 min. required

(0.463 = 90 / 18)

To figure p.p.m. dosing rate from dry-feeder check weights, the reasoning is backwards, or the reverse of the order given in (a) above. Or, by recalling a little algebra, merely transpose equations (b) or (c) above, and solve for p.p.m., thus:

$$\text{Transposing equation (b):} \qquad \text{p.p.m.} = \frac{3.475 \times 1440}{8.33 \times 3 \times 16 \times 5} = 2.5$$

$$\text{Transposing equation (c):} \qquad \text{p.p.m.} = \frac{\text{oz. per 5 min.}}{\text{m.g.d.} \times 0.463}$$

RATE OF FILTRATION

Two units are commonly used for expressing filtration rates—gallons per minute per sq. ft. of sand, and millions of gallons per day per acre of sand. The latter is the accepted unit (abbreviated either m.g.d.a. or m.g.a.d.) and 125 m.g.d.a. is the so-called standard rate for rapid filters, which is equivalent to 2.0 gal./min./sq.ft.

The m.g.d.a. rate for the filter plant as a whole is usually figured daily, since it gives a useful check on the accuracy of the gauge or indicated rate. This calculation may be worth discussion since it is apt to prove a bit puzzling to the beginner.

First remember that any rate-of-flow expresses simply a ratio of quantity to time; thus m.g.d. is millions of gallons per day's time, and similarly, m.g.d.a. is millions of gallons per acre per day's time. Thus a filter having an area of 1/100 acre of sand which delivers 1.25 m.g.d. is filtering at 1.25 × 100 or 125 m.g.d.a. However, to calculate m.g.d.a. rate for all filters in the plant over any one day's operation, it is necessary to take into account what fraction of the total sand area of all filters was used (hypothetically, of course) for the full 24 hours of the day in question. Or, what amounts to the same thing, equivalent to how many hours of the 24 did all the filters in the plant operate?

For example, a plant having five filters has 5 × 24 or 120 hours of filter service available. Yet actually, with a filter or two idle for part of the day, the sum total of filter service hours for any day will always be less than the available 120 hours. If we assume that on a given day the sum total of filter service hours was 90, then it is plain that on that day the same output of water could have been filtered with the whole plant operating 90 ÷ 120 × 24 or 18 hours. Assuming the plant actually filtered 6.0 m.g. that day, then its output equivalent to full operation over 24 hours would have been 24 ÷

18 × 6 or 8.0 m.g. Finally if the total sand area of all filters in this plant was 1/17 of an acre, then its m.g.d.a. rate for the day was 8 × 17 or 136.

Stated briefly, then, the m.g.d.a. rate for the filter plant for any day is calculated by multiplying its hypothetical output, assuming all filters operating a full 24 hours, by the reciprocal of the total sand area of all filters in acres. Expressed as a formula, this would be written:

$$\text{m.g.d.a.} = \frac{\text{available hours service} \times \text{actual output in m.g.} \times 43{,}560}{\text{actual service hours} \times \text{sand area in sq. ft.}}$$

Available service hours and total sand area being constants for any given plant, the formula may be simplified further for local use.

DISCHARGE AND VELOCITY

A formula presents a mathematical thought, fact, or rule, usually in algebraic shorthand. It is a concise and exact statement of procedure, designed as a time, thought and effort saver; as such it may be used to advantage always.

To compute the volume (V) of a tank or standpipe the rule is area (A) times length or depth (l), which is expressed in the formula $V = Al$. Discharge of flowing water, whether from a tank, a pipe, a filter or a river, is measured in terms of a quantity (Q) which expresses not merely the volume of discharge, but volume per given unit of time, say per minute. Since the quantity (Q) discharge per minute depends both on the area of the cross-section of the opening of the pipe or channel (A), and on the velocity of the water column or distance traveled per minute (v), the discharge (Q) is equal to their product, expressed by another simple formula $Q = Av$; or $v = \frac{Q}{A}$; and $A = \frac{Q}{v}$. Note that volume of discharge (Q) is three-dimensional; area (A) is two-dimensional; and length or distance (l) is one-dimensional. Then note from the formulae that 3-dimensional Q is the product of 2-dimensional A times 1-dimensional v; that 1-dimensional v results from the division of 3-dimensional Q by 2-dimensional A; and finally that 2-dimensional A results from the division of 3-dimensional Q by 1-dimensional v.

Solution of two or three familiar types of problems by means of simple substitution in these formulae will illustrate their usefulness.

Problem 1. The drop in water level on a filter is measured at 1

inch in 20 seconds over a sand area of 640 sq. ft. What is the filter rate of flow in cubic feet per minute? Here the discharge rate or quantity of water per minute is required, with area and velocity given, which calls for the form $Q = Av$. Before substituting, first change the units of measurement as given in the problem into their equivalent in terms of those required in the answer, that is, seconds to minutes, and inches to feet. Thus:

1 inch per 20 seconds = 3 inches per minute
and, 3 inches per minute = $\frac{1}{4}$ ft. per min. = v
640 sq. ft. = A

Substituting in $Q = Av$; $Q = 0.25 \times 640 = 160$ cu.ft./min.

Problem 2. A square conduit is to be designed of such size that it will discharge 32 m.g.d. at a specified velocity of 1 ft. per sec. What should be the dimensions of the cross-section opening in feet? Being a square opening, the square root of the area of the section in square feet will be the required square dimension. One must first transpose m.g.d. into equivalent cu. ft./sec. to obtain units of measurement common to all three terms, and then substitute in the equation $A = \frac{Q}{v}$. Thus:

32 m.g.d. = 32,000,000 ÷ 7.48 = 4,278,075 cu.ft./day
and, 4,378,075 ÷ 86,400 sec./day = 49.5 cu.ft./sec. = Q

Since v is given 1 ft./sec. velocity, then by substituting in $A = \frac{Q}{v}$,

$A = \frac{49.5}{1} = 49.5$, the square root of which is 7.04 ft.

Problem 3. A filter plant is operating on one settling basin 30 × 150 ft., containing 15 ft. depth of water. The plant output is 4.04 m.g.d. What is the velocity of flow through the basin in feet per day and what is the theoretical retention time of the latter in hours? Since v is required in ft. per day, then Q must be expressed in cu.ft./day and A in sq. ft., thus:

Q = 4.040,000 ÷ 7.48 = 540,000 cu.ft./day
and, A = 15 ft. × 30 ft. = 450 sq. ft.

Substituting in $v = \frac{Q}{A} = \frac{540,000}{450} = 1200$ ft./day

Since the basin length is 150 ft. and the velocity is 1,200 ft./day, then the water in the basin will change completely 1,200 ÷ 150 = 8 times per day, and its retention time in the basin is 24 ÷ 8 = 3 hours. Another way to find retention time would be to divide the

plant output in gallons by the capacity of the basin in gallons and obtain 8 changes of water per day, requiring 3 hours per change.

USE OF CHEMICAL EQUIVALENTS AND FACTORS

Determining correct theoretical softening treatment, such as that with lime and soda, offers a good example of straight chemical computation. In this kind of calculation, involving chemical reactions and some arithmetic, factors based upon chemical equivalents are indispensable tools. Their use greatly simplifies matters. Yet it requires, withal, due understanding of certain fundamentals of inorganic and analytical chemistry. This attempt at brief explanation of principles involved in the derivation and use of equivalents and factors, needs assume that the reader is on familiar terms with such things as the law of definite proportions, valence, theory of of ionic dissociation, chemical equations, etc.; and also has progressed to the stage where he can make a complete mineral analysis of water, upon which any softening treatment must necessarily be based.

By means of a precise laboratory experiment it is easily proven that one atomic weight of sodium in grams will liberate one gram of hydrogen when treated with an acid; one-half an atomic weight of zinc (65.4 ÷ 2, or 32.7 grams) does the same thing; and if aluminum is used, only one-third of its atomic weight (27 ÷ 3, or 9 grams) is required. These unit-weights of the elements, which are equivalent to one gram of hydrogen, and hence to each other in terms of reacting or combining value, are known as the combining weights of the elements. The simple proportion that combining weights bear to atomic weights (1:1, 1:2, 1:3, etc.) is known as valence. Dividing atomic weight by valence gives the combining weight.

EQUIVALENT WEIGHTS OF COMPOUND RADICALS

This principle of chemical combination of the elements by definite, unit-weight quantities only, may be extended to compounds as well, if we think of the latter as comprised of associated units called radicals, that dissociate in water in the form of ions which obey the same law of combination as do the simpler units or elements. In the case of radicals and compounds, their combining weights are usually spoken of as equivalent weights. The equivalent weight of any radical is found by dividing the sum of the atomic weights of the elements which compose it, by its valence, the same as was done to find the combining weight of an element. Thus the equivalent weight of

the radical $(OH)^-$ = 17 ÷ 1, or 17; of $(SO_4)^{--}$ = 96 ÷ 2 = 48; and of $(PO_4)^{---}$ = 95 ÷ 3, or 31.7.

The equivalent weight of compounds such as salts is found by calculating that fraction of the molecular weight which contains the combining weight of either metallic or non-metallic constituent.[1] Perhaps a simpler rule would be: "to obtain the equivalent weight of a compound, divide its molecular weight by the total number of electrons released by either the base or acid constituent in combining." To illustrate, the equivalents of NaOH, Na_2CO_3, $CaSO_4$, $CaCO_3$ and $Al_2(SO_4)_3 \cdot 18H_2O$ are computed as in table 1.

From these equivalent weights it is a simple matter to derive factors[2] by which, for example, a known weight of $CaSO_4$ may be multiplied in order to obtain the exact equivalent weight of Na_2CO_3

TABLE 1

Calculation of the Equivalent Weight of Compounds

COMPOUND	MOLECULAR WEIGHT	ELECTRONS RELEASED (+) (=)	EQUIVALENT WEIGHT
Na^+OH^-	40	1	40
$Na_2{}^+CO_3{}^{--}$	106	2	53
$Ca^{++}SO_4{}^{--}$	136	2	68
$Ca^{++}CO_3{}^{--}$	100	2	50
$Al_2{}^{+++}(SO_4)_3{}^{--} \cdot 18H_2O$	666	6	111

required for reaction. These factors are merely the ratios of the equivalent weights, thus:

Weight		Weight			
$CaSO_4$	:	Na_2CO_3::	68	:	53
Found		Required			

from which, $68Na_2CO_3 = 53CaSO_4$, or $1.19\ Na_2CO_3 = 1.0\ CaSO_4$, which simply means that 1 part of $CaSO_4$ reacts with 1.19 parts of Na_2CO_3.

To change any given weight of hardness as $CaSO_4$ into its equivalent of the reagent, Na_2CO_3, merely multiply by the factor 1.19.

[1] For a more complete discussion of combining weights and chemical equivalents, see Chapter IX, *Chemical Calculations* by Long and Anderson, McGraw-Hill Co.

[2] For tables of chemical equivalents and factors used in water analysis, see Thoreaux, Eldridge and Mallman, pp. 180–4. Also Hopkins' *Water Purification Control*, p. 175.

Should the reverse be desired, then use the reciprocal of 1.19, which is 0.84, for the multiplier.

Given a table of chemical equivalents similar to that above, it is possible (without resorting to writing and balancing the chemical reaction equation) to say that since 50 p.p.m. $CaCO_3$ alkalinity is the equivalent of 111 p.p.m. filter alum, then 1.0 p.p.m. alkalinity is equivalent to 111 ÷ 50, or 2.22 of alum. In this way the fact is quickly established that every p.p.m. alum applied requires about one-half a part of alkalinity for reaction.

It is similarly possible to calculate quickly and easily from the table of equivalents or factors, how much lime or soda in any form will be required to treat any given amount of hardness, in any form. To avoid any possible complications, perhaps the best procedure is to figure first all the hardness constituents (shown by analysis) as their $CaCO_3$ equivalent. Then by simple multiplication of the total amount of hardness to be treated with lime (usually the sum of free CO_2, bicarbonate hardness and magnesium) by its lime equivalent factor (0.74), the result is total lime (as $Ca(OH)_2$) required. For the soda required (as Na_2CO_3) merely multiply non-carbonate hardness as $CaCO_3$ by its Na_2CO_3 equivalent factor 1.06.

As a final illustration, the entire scheme for calculating dosage of lime and soda for a given hard water might be stated concisely as follows:

1. First tabulate an analysis of the water showing all forms of hardness to be precipitated in terms of p.p.m. of $CaCO_3$, thus:

Water-Hardness to be precipitated

Free CO_2	10	p.p.m.	as	$CaCO_3$
Bicarbonate Hardness	150	"	"	"
Magnesium	70	"	"	"
Non-carbonate Hardness	50	"	"	"

2. Refer to a list of fundamental reaction equations for the lime-soda process, such as table 2, and note that in each, *one* equivalent of the softening reagent reacts with *one* equivalent of the hardness constituent.

3. Finally consult a table of equivalent factors and note that 1 p.p.m. $CaCO_3$ hardness is equivalent to 0.74 p.p.m. $Ca(OH)_2$, and to 1.06 p.p.m. Na_2CO_3. Add the hardness constituents which are to be treated with lime, viz., 10 p.p.m. CO_2 + 150 p.p.m. bicarbonate hardness + 70 p.p.m. magnesium = 230 p.p.m. $CaCO_3$

$\times$ 0.74 = 170.2 p.p.m. lime as $Ca(OH)_2$ required, and 50 p.p.m. non-carbonate hardness $\times$ 1.06 = 51.8 p.p.m. Na_2CO_3 required.

TABLE 2

Equations for the Lime-Soda Process

(1) $H_2CO_3 + Ca(OH)_2$	$= CaCO_3 + 2\ H_2O$
(2) $Ca(HCO_3)_2 + Ca(OH)_2$	$= 2\ CaCO_3 + 2\ H_2O$
(3) $Mg(HCO_3)_2 + Ca(OH)_2$	$= MgCO_3 + CaCO_3 + 2\ H_2O$
(4) $MgCO_3 + Ca(OH)_2$	$= Mg(OH)_2 + CaSO_4$
(5) $MgSO_4 + Ca(OH)_2$	$= Mg(OH)_2 + CaSO_4$
(6) $CaSO_4 + Na_2CO_3$	$= CaCO_3 + Na_2SO_4$

Examples could be given to illustrate other similar problems. Methods of preparing simple nomographic charts could be added. If this presentation has stimulated your curiosity and helped to give you a better understanding of the elementary mathematics of water treatment, it has served its purpose.

HYDRAULICS AND WATER WORKS ENGINEERING

By H. N. Lendall

Hydraulics may be defined as the science which deals with water in motion. It is customary, however, to include under the subject a study of the laws relative to water at rest. First considered will be the chief properties of water.

The weight of water varies with the temperature and its degree of purity. The weight per unit volume (cubic foot) is greatest at 39.3 degrees Fahrenheit and least at the boiling point. For ordinary temperatures and unless great precision is required it may be considered that: 1 cubic foot = 7.5 gallons, weighs 62.5 pounds; 1 U. S. gallon weighs 8.33 pounds.

Atmospheric pressure causes water to flow in syphons, to rise in tubes, makes the suction pump possible and other hydraulic machines depend upon it in varying degrees. Average atmospheric pressure is 14.7 pounds per square inch. Other properties of water are viscosity and compressibility, but the effect of these on the solution of many water works problems is so small that they may be neglected.

ELEMENTS OF PRESSURE

Since water weighs 62.5 lb. per cu. ft., a column of water one square foot in cross section and 20 feet high would weight 1,250 lb.; hence the pressure at the bottom of the column is 1,250 lb. per sq. ft. or 8.68 lb. per sq. in.

Therefore, if p = pounds per square inch, and h = depth of water or "head"—

$$p = \frac{62.5}{144} h = 0.434\,h$$

$$h = \frac{144}{62.5} p = 2.3\,p$$

$\frac{p}{w}$ is designated as pressure head.

A paper presented at the New Jersey Section meeting at Asbury Park, N. J., Oct. 22, 1938, by H. N. Lendall, College of Engineering, Rutgers University, New Brunswick, N. J.

Water flows due to a difference of elevation, a difference of pressure, or both, and the greater this difference the higher will be the velocity of flow. Suppose a tank is so arranged that water from an orifice flows vertically upwards (fig. 1). The jet will not quite reach the elevation of the water in the tank due to air resistance and friction of the edges of the orifice. But for these factors, it can be assumed that it would rise to this elevation. If at the orifice "A" the velocity is "v" and since at "B" it is zero, the average velocity is $\frac{1}{2}$ v. If it takes the water "t" seconds to go from A to B, then the distance traveled: $h = \frac{1}{2}$ vt.

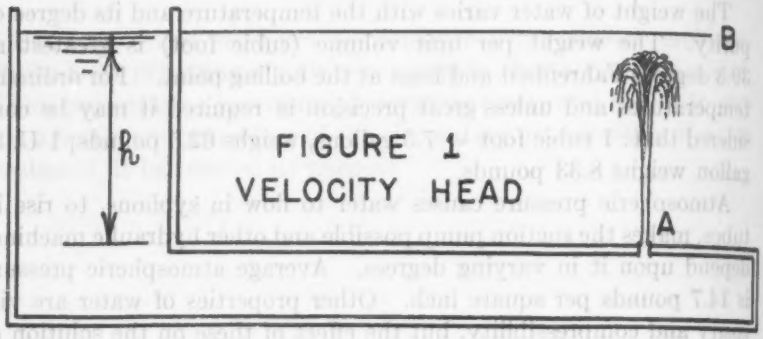


FIGURE 1
VELOCITY HEAD

The change in the velocity from A to B is due to the force of gravity causing "v" to decrease 32.2 ft. per second every second ("g"). Therefore, the total change

$$v = 32.2\,t = gt$$

$$\text{and} \quad t = \frac{v}{32.2} = \frac{v}{g}$$

$$\text{Hence,} \quad h = \tfrac{1}{2}\,vt = \tfrac{1}{2}\,v \times \frac{v}{32.2} = \frac{v^2}{64.4} = \frac{v^2}{2g},$$

$$\text{and} \quad v = \sqrt{2gh}$$

$\frac{v^2}{2g}$ is called the velocity head.

FLOW IN PIPES

Water flows in a pipe for the reason that energy has been imparted to it due to a change in head. Referring to fig. 2, at point A the water has a velocity v_A and a pressure of $\frac{p_A}{w}$. There is also a difference of elevation between A and B of "z" feet: hence with respect to B the total energy in the water is

$$W\left[\frac{v_A^2}{2g} + \frac{p_A}{w} + z_A\right]$$

where "W" is the total weight of water flow past the section in a unit of time.

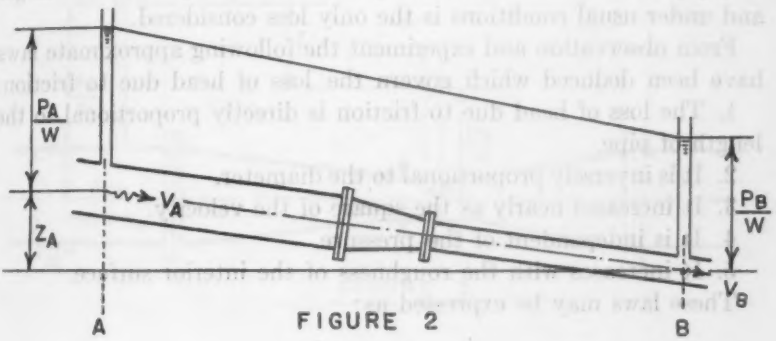


FIGURE 2

Likewise, the total energy at B is:

$$W\left[\frac{v_B^2}{2g} + \frac{p_B}{w} + (z_B = 0)\right]$$

In any machine the total energy put in is equal to the energy taken out plus any losses due to friction, etc. The section of pipe "A-B" in fig. 2 can be likened to a machine in that the total energy available at A is equal to the total energy at B plus any losses of energy between the sections due to friction. This loss of energy may be expressed as Wh_f, where h_f is the head loss due to friction or friction head. The above may be expressed as follows:

$$W\left[\frac{v_A^2}{2g} + \frac{p_A}{w} + z_A\right] = W\left[\frac{v_B^2}{2g} + \frac{p_B}{w} + (z_B = 0)\right] + Wh_f$$

or dividing by W:

$$\frac{v_A^2}{2g} + \frac{p_A}{w} + z_A = \frac{v_B^2}{2g} + \frac{p_B}{w} + z_B + h_f \qquad (1)$$

The above equation may be stated as follows: The friction head between any two sections on a pipe line is equal to the difference of the velocity heads, pressure heads and elevations at those sections.

FRICTION LOSSES

Frictional losses are caused by the friction of water against the walls of the pipe, change of direction of flow by fittings and valves, entrance from a reservoir into a pipe line and other conditions. For long pipe lines the loss due to pipe friction is very much the larger and under usual conditions is the only loss considered.

From observation and experiment the following approximate laws have been deduced which govern the loss of head due to friction:

1. The loss of head due to friction is directly proportional to the length of pipe.
2. It is inversely proportional to the diameter.
3. It increases nearly as the square of the velocity.
4. It is independent of the pressure.
5. It increases with the roughness of the interior surface.

These laws may be expressed as:

$$h_f = \frac{fl}{d}\frac{v^2}{2g}$$

where l = length of pipe
d = diameter in feet
f = abstract number dependent on the roughness
$\frac{v^2}{2g}$ = velocity head due to mean velocity.

By transposing the above formula,

$$v = \sqrt{\frac{8g}{f}}\sqrt{\frac{h_f}{l}\frac{d}{4}}$$

$$= C\sqrt{RS}$$

where $S = \frac{h_f}{l}$, $R = \frac{d}{4}$, $C = \sqrt{\frac{8g}{f}}$.

The value of "C" will vary with the material and age of the pipe. For cast-iron, C is usually taken as 100.

Many studies and investigations have been made resulting in the advancement of many formulae for determining the friction losses in pipe lines under varying conditions. Among these the Williams and Hazen formula has been widely used. Tables giving the loss of head per thousand feet for different rates of flow in commercial sizes of pipe have been compiled and published.

ELEMENTS OF FLOW

When water flows through a pipe of varying diameter and all sections are filled with water, the same quantity of water passes

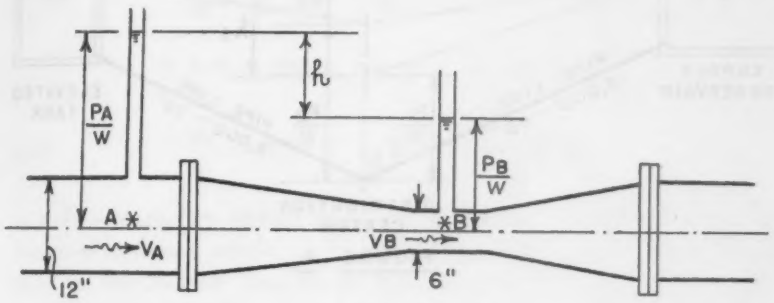


FIGURE 3

each section in one second. This is called steady flow. If the quantity is "q" cubic feet per second, then:

$$q = \text{pipe area} \times \text{velocity in feet per second}$$

and for a pipe line made up of several sizes:

$$q = a_1v_1 = a_2v_2 = a_3v_3 \text{ etc.} \tag{2}$$

Hence

$$\frac{v_1}{v_2} = \frac{a_2}{a_1} = \frac{d_2^2}{d_1^2} \tag{3}$$

Hence for steady flow the velocity in a 6-inch pipe would be four times that in a 12-inch pipe.

In order to show the practical application of the preceding discussion, solutions of two problems are given.

A venturi tube is shown by fig. 3, and it is proposed to determine the discharge from the difference of pressures indicated by the gages at the inlet and throat.

The inlet and throat diameters are 12 inches and 6 inches respectively; the inlet pressure is 30 lb. per sq. in. and pressure at the throat is 19.43 lb. per sq. in.

$$30 \text{ lb./sq. in.} = 69.12 \text{ ft. head,}$$
$$19.43 \text{ lb./sq. in.} = 44.77 \text{ ft. head.}$$

From equation (1)

$$\frac{v_A^2}{2g} + \frac{p_A}{w} + z_A = \frac{v_B^2}{2g} + \frac{p_B}{w} + z_B + h_f$$

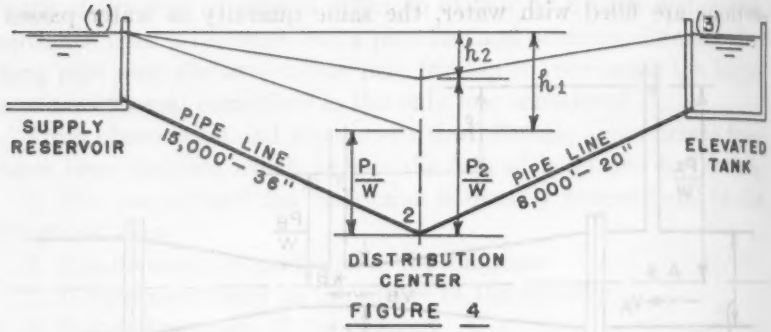


FIGURE 4

The loss in a venturi tube is very small and in this instance the assumption will be made that $h_f = 0$.

$$z_A = z_B$$

$$\therefore \frac{v_{12}^2}{2g} + 69.12 = \frac{v_6^2}{2g} + 44.77$$

Equation (3) $\qquad v_6 = 4v_{12}$ and $v_6^2 = 16v_{12}^2$

$$\therefore \frac{16v_{12}^2}{2g} - \frac{v_{12}^2}{2g} = 69.12 - 44.77 = 24.35 \text{ ft.}$$

$$2g = 2 \times 32.2 = 64.4 \qquad v_{12} = \sqrt{64.4}\sqrt{\frac{24.35}{15}} = 10.21 \text{ ft./sec.}$$

and
$$q = av = \frac{3.1416 \times \overline{12}^2}{4 \times 144} \times 10.21$$
$$= 8.02 \text{ cu. ft./sec.}$$

For the second illustration, fig. 4 shows a city supplied from a reservoir through 15,000 feet of 36-inch pipe. The elevation of water surface in the reservoir (Point 1) is 250 feet and of the city (Point 2), is 110 feet. The maximum demand is at the rate of 22.5 m.g.d.

At the surface of the reservoir the velocity head is 0, the pressure is zero and z_1 = the elevation, 250.

At the city the velocity head is approximately 0.4 foot, $z_2 = 110$ and it is desired to find the pressure for the given conditions. The friction head for 22.5 m.g.d. flowing through 15,000 ft. of 36-inch cast-iron pipe (C = 100) is 47.7 feet.

From equation (1):

$$\frac{v_1^2}{2g} + \frac{p_1}{w} + z_1 = \frac{v_2^2}{2g} + \frac{p_2}{w} + z_2 + h_{f_{36}}$$

$$0 + 0 + 250 = 0.4 + \frac{p_2}{w} + 110 + 47.7$$

and $$\frac{p_2}{w} = 91.90 \text{ ft.} = 39.9 \text{ lb. per sq. in.}$$

If a 25 stream fire should occur at the time of maximum demand, the total demand would be at the rate of 31.5 m.g.d. The friction head in the 36-inch line would then be 88.5 feet and the velocity head equal to 0.75 ft.

Equation (1) becomes:

$$0 + 0 + 250 = 0.75 + \frac{p_2}{w} + 110 + 88.5$$

and $\frac{p_2}{w}$, the pressure at the city is 50.75 ft. = 22.0 lb./sq. in.

If an elevated tank, shown in fig. 4, were to be erected so that its water surface (Point 3), when full is at elevation 250, then the city would be supplied from the reservoir and the elevated tank at the same time and

$$\frac{v_3^2}{2g} + \frac{p_3}{w} + z_3 = \frac{v_2^2}{2g} + \frac{p_2}{w} + z_2 + h_{f_{20}}$$

also $$\frac{v_1^2}{2g} + \frac{p_1}{w} + z_1 = \frac{v_2^2}{2g} + \frac{p_2}{w} + z_2 + h_{f_{36}}$$

Therefore $$h_{f_{20}} = h_{f_{36}}$$

Thus the flow in the 36- and 20-inch lines will be such that the friction losses are equal.

By a method of trial it can be found that with flows of 24.25 m.g.d. in the 36-inch line and 7.25 m.g.d. in the 20-inch line the friction loss in each is 54.8 ft.

In the same manner as above, with the elevated tank installed, the pressure at the city

$$\frac{p_2}{w} = 250 - 110 - 54.8 - 0.41 = 84.79 \text{ ft.} = 36.8 \text{ lb. per sq. in.}$$

This last example shows the effect of an elevated tank on the distribution system at times of peak demand.

SPECIFICATIONS AND TESTING OF DEEP WELL TURBINE PUMPS

By James C. Harding

Most deep well turbine pumps have in the past been purchased without any specifications or else with very sketchy ones. The question naturally arises therefore as to why one should go to the trouble and expense of preparing them. Instead why not call in a representative of some reliable pump company, show him the well, tell him the conditions, and direct him to send up a pump to fit them? The answer is that this method has resulted in the installation of many inefficient pumps and, more important, of pumps that were not suited for the particular work they had to do.

Detailed and adequate specifications are, generally speaking, a necessary first step leading to the installation of a first-class pumping unit because to prepare them, the purchaser has really to get to work and find out what his water supply conditions are and what he needs. The seller, to meet the specifications and the competition they permit, has to bring forth his best product. If we turn our entire problem over to the pump salesman, we are taking a chance because after all the salesman's firm is paying him to sell his pumps and not to make water supply investigations; also, whereas he may be an authority on pumps, he generally knows less about wells and still less about water supply conditions in our water system.

Without specifications it is difficult to get fair competition, because it is practically impossible to judge the merits of the various pumps upon which prices are submitted if these prices are based on materially different units. The purchaser may say that he does not care about getting competition and does not mind paying a few dollars more for his pump if he can deal with a firm that he knows to be reliable. We all favor dealing with firms that have demonstrated to us in the past that they have a good product. This is a good practice with much of the material we buy such as valves, hydrants and meters.

A paper presented at the New Jersey Section meeting at Asbury Park, N. J., Oct. 21, by James C. Harding, Cons.Eng., New York City.

However, there has been so much development in the efficiency of deep well turbines during the past few years that the man that we bought our pump from five years ago may not have kept up with the general advance in the industry.

Another circumstance that makes competition desirable is the fact that different manufacturers design their pumps to operate most efficiently while pumping at rates that their own experience shows are most commonly used. The company that might have the most efficient pump for 200 g.p.m. might have an inferior product for 250 g.p.m.

Comprehensive specifications, particularly if they describe a test that can actually be made in the field, also have the effect of restraining the tendency of some zealous salesmen to promise higher efficiency for their unit than it is capable of producing.

CONTROVERSIAL POINTS NEED STUDY BY A COMMITTEE

It is the purpose of this paper to bring to the attention of the water works operator and engineer some of the more obvious points which should be considered in the selection of deep well pumping equipment and to make suggestions concerning certain features which should be considered in writing up the specifications governing the purchasing and testing of such equipment. It is not the intention of this paper to touch on such controversial features as water lubricated versus oil lubricated pumps, material to be used for impellers and structural details. These important items, if they are to be dealt with at all, should be considered by a committee large enough to bring to the subject the benefit of long term operation under a multiplicity of conditions in various parts of the country.

The problem of preparing specifications for and the purchasing of deep well turbine pumping equipment resolves itself into four phases. First, what information should be given to the pump manufacturer concerning local conditions and the performance that is desired of the equipment. Second, what information regarding his product should the manufacturer be required to submit with his bid so that an intelligent analysis of his proposal may be made. Third, what points should be considered in judging the merits of the various pumps upon which prices may be obtained; and fourth, how may the equipment be tested in the field so that the purchaser may be sure that he is getting what the manufacturer agreed to give him.

It is recommended that anyone drawing specifications for deep well turbines obtain and read carefully Section E of the Standards of the Hydraulic Institute as this bulletin contains much helpful data. The rules therein set forth, however, should not be followed too literally as they very naturally represent the manufacturer's viewpoint.

INFORMATION TO BE FURNISHED BY THE PURCHASER

The information to be furnished in the specifications to the pump manufacturer regarding the well in which the pump is to be installed should include the following: whether the well is constructed in gravel or rock; the diameters and depth of the well; the static water level in the well; anything unusual about the water including corrosiveness and likelihood of sand being pumped; and (last but not least) whether the well is materially out of plumb or crooked. It is probable that no other factor contributes so largely as this to turbine troubles.

Besides giving information regarding the well, the specifications should set forth as much information as is available regarding probable operating conditions. This information should include the following:

(a) The quantity of water desired, which quantity should be less than the tested capacity of the well and should be tied in with the total head against which the pump is to operate.

(b) The depth of setting wanted, in other words, the distance between the foundation of the pump and the top of the bowl assembly. Unless a well has been tested over an extended period this is a rather difficult figure to estimate. Too short a depth of setting may allow air to be pulled in if the suction pipe is short, and in any event, the pump will have to work under a suction lift, which is not recommended for pumps of this type. On the other hand, if the depth of setting is overestimated, the efficiency of the unit is decreased because of the additional friction losses from the water in the discharge column and from the additional shaft bearings. It is better, however, to play safe and have the setting too deep rather than too shallow. The usual practice is to try to get the top of the pump bowls ten feet below the low water pumping level. Usually, the only way that the proper depth of setting in a new well can be accurately determined is by a reasonably extended pumping test with temporary equipment at the desired capacity and during a dry season.

(c) The bidder should be told the head against which the pump must work. This includes the static head above the center line of the pump discharge, the friction loss in the discharge piping and the depth to the expected pumping level. In an operating system, the static head can be measured with calibrated pressure gauges installed on the main into which the pump is to discharge. The friction loss, however, presents a problem where discharge lines are long unless the pump to be installed replaces a pump of similar capacity or where it is to be one of several pumps in a well field that has been operated previously. It is suggested that where convenient, in addition to estimating the friction loss with the aid of flow tables, flow tests be made on the mains into which the well discharges by flowing the nearest hydrant at the required rate and measuring the drop in pressure on a gauge near the point of connection. This is frequently a good index of the friction loss to be expected.

LENGTH OF SUCTION PIPE AND POINT OF DISCHARGE

(d) The specifications should state the length of suction pipe or tail piece to be furnished. The customary length is ten feet, although twenty-foot and thirty-foot lengths are very common. A suction strainer, not to be confused with a well strainer, should be required by the specifications if there is any chance of large foreign objects entering the pump.

(e) Information should be given whether the pump is to discharge above or below the floor. The first type of construction is favored by some in order to lessen the chance of pollution getting into the well. However, under many conditions the below-ground discharge is safe and is particularly advantageous where the pumping station is not to be heated.

(f) The manufacturer should be so advised if high efficiencies and only a small change in capacity are desired over a fairly wide variation in head, such as will be the case when there is a considerable draw-down in the well and a marked difference in water level during various seasons of the year and where the discharge pressure varies considerably due to draft conditions in the distribution system or to fluctuating levels in the high service reservoir or standpipe. It is rare that the ideal condition is encountered where there is no variation in draw-down or discharge head and only one point on the pump curve has to be considered.

(g) It is recommended that as a rule a non-overloading impeller

be required in order to prevent damage if head conditions vary greatly from those expected.

(h) Detailed information should be given as to the power conditions, what the source is to be, electricity, gasoline, etc., and if electricity, the voltage, number of cycles and phases. Generally the power company should be consulted to determine whether power lines are ample in size, whether any special type of motor will be required, what the starting loads must be held down to, etc. If the pump is to be motor driven, the specifications should state the maximum speed, the minimum horsepower, which should contain an ample factor of safety, and should require protection against back-spinning or reversing.

AIR LINE TO MEASURE WATER DEPTH BELOW PUMP HEAD

(i) The specifications should require that an air line be installed for measuring the depth of water below the pump head. This line is usually $\frac{1}{4}$-inch and may be of copper tubing if there is plenty of clearance between the discharge pipe and the well casing; however, where there is any chance that the tubing might be crushed between the column and the side of the well, it is better to specify wrought iron. The manufacturer should also supply an altitude or pressure gauge and hand pump with the air line. The bottom of the air line is frequently left at the same elevation as the top of the pump bowls. However, if there is sufficient room and the line can be fastened securely to the suction pipe, it is better to terminate it near the end of the suction pipe.

(j) The type of drive desired should be noted. Most turbine units are motor driven with the motor directly connected to the column shaft; however, geared, belted and the other types of drives are occasionally used where there are special conditions or where the source of power is other than electricity.

(k) If a guaranteed efficiency is to be required, the capacity and head for which the efficiency is to be guaranteed and the method of test should be adequately set forth in the specifications together with penalties for non-fulfilment. It is suggested that if pumps are purchased on a guaranteed efficiency basis, the pumps be set by the manufacturer or else that the installation be made in the presence of his representative or agent so that there will be no argument as to whether the pump was properly installed. The specifications should state that all line shaft bearing, column, motor, and

velocity head losses shall be charged to the pump. It should also state how the equipment is to be field tested. The subject of guaranteed efficiency is discussed elsewhere in this paper under "Information to be Furnished by the Manufacturer" and "Testing."

INFORMATION TO BE FURNISHED BY THE MANUFACTURER

The specifications should require that there be submitted with the bid complete information regarding the construction of the pump and its anticipated performance including drawings, curves setting forth the wire-to-water efficiencies and the capacities at various heads and the shut-off head. Also by a data sheet, the specifications should give the following information:

(1) *Discharge Column:* inside diameter, material, type of joints, length of section, weight per foot of supporting pipe only.

(2) *Shaft Enclosing Pipe:* inside diameter, material, length of section, weight per foot.

(3) *Line Shaft:* diameter, material, bearing spacing, length and type of bearing.

(4) *Pump Shaft:* diameter through impellers, material.

(5) *Pump Bowls:* outside diameter, material, number of stages.

(6) *Impellers:* material, how connected to pump shaft.

(7) *Suction Pipe:* size, material, length.

(8) *Discharge connection:* size.

(9) *Electric Motor* (if used): manufacturer's name, rated horsepower, speed, type, true efficiency at full, three-quarter or half load.

(10) *Lubricating System:* oil or water, size and type.

(11) *Total Weight:* of entire pumping unit.

The curves accompanying the bid should show the anticipated capacity and wire-to-water efficiency. However, it is recommended that where turbines are purchased on a guaranteed basis, the capacity and efficiency of the pump against the designed head be also stated in writing in the proposal. It is further recommended that in cases where the exact heads against which the pump is to work are speculative, the bidder be required to state the capacity and efficiency at other heads, say for example, five and ten per cent above and below the design point, even if he will not guarantee them. The Standards of the Hydraulic Institute forbid the manufacturer to guarantee specific performance at other than the design point and therefore many manufacturers will only guarantee one point on the curve. There may be good reasons for this rule. However, the

purchaser of a pump to be used against varying heads certainly needs to know what his pump is going to do under actual operating conditions.

CHOOSING THE PUMP

In deciding as to which pump to buy, the purchaser should consider, among other things, the following items.

First, and perhaps foremost, the general reputation of the manufacturer. It is well to get from him a list of nearby installations and to contact the operator of the equipment to find out whether the pump has given good service; whether it met the specifications, particularly as regards guaranteed efficiency; and, whether dealings with the manufacturer have been satisfactory, both as regards the initial installation and the service after the pump was put in use.

The second thing to consider is the ruggedness of the pump including its total weight, sizes of bearings, shafting, etc., and the various materials of which the pump is constructed.

The third point to examine is the efficiency of the unit. If prices are obtained from several manufacturers and one has a guaranteed efficiency considerably higher than the others, the reasons for this high efficiency should be investigated. The manufacturer should be asked what motor efficiency, column loss and line-shaft loss he has used and these estimates should be compared with those of other bidders. If the bidder guaranteeing the highest wire to water efficiency has been less conservative than the other bidders in estimating these losses, which are not strictly speaking a part of the pump itself, it is an indication that his pump may not be more efficient than those of his competitors.

The first cost of the unit should be considered. But in addition to this first cost, it is well to consider power costs for a period of several years in advance. For example, Manufacturer A might bid $1,500 for a unit with a guaranteed wire to water efficiency of sixty per cent and Manufacturer B $1,700 for a unit having a guaranteed overall efficiency of sixty-five per cent. If these units were to pump an estimated quantity of 200 million gallons during three years against a total dynamic head of 200 feet with current at 2¢ per kilowatt hour, the total cost for electricity for Unit A would be $4,200 and for Unit B $3,877. In this three-year period, therefore, the additional capital cost of $200 would have been offset by a power saving of $323 with the more efficient pump.

In considering the efficiency of the unit, it is important to consider the efficiency at other points than the design point in most installations. We frequently hear of wells that will produce many times the quantity of water that the pump need deliver, where the draw-down fluctuates a matter of only inches and where the discharge head is constant. Unfortunately, however, most of us are faced with situations where we have to get every gallon we can out of the well, which means that the draw-down is going to vary and, in addition, we have conditions in our force main where during the day the head to be pumped against is materially less than it is at night. We therefore have to have a pump that will give us good efficiency over a wide range of heads and we do not know just what this range is going to be. Generally speaking, it is better to sacrifice a few points in maximum efficiency at the design point in favor of a higher average efficiency over a wider range.

TESTING THE EQUIPMENT

After we have spent many hours listening to the conflicting claims of the pump salesmen, have analyzed the data submitted and have gone over our estimated capital costs and current consumption and finally purchased our pump, we are faced with the problem of determining whether we are actually getting what the manufacturer agreed to furnish. The writer's experience has been that the unit as installed may vary considerably in performance from what the manufacturer promised in his bid. It may be higher or lower in efficiency and the capacity is almost sure to vary from that anticipated, although not seriously enough to cause the rejection of the unit. The best way to make sure that we have obtained what we wanted is to actually try it out.

If the pumping unit is going to be tested, it is important that the specifications describe definitely the method of test, how and where measurements are to be made, when the test is to be made, and for how long it is to be run. Tests that cannot easily be made in the field with the equipment owned by the average water works and where it is necessary to go into involved calculations as to line losses, column losses, motor losses, etc., should be avoided. It is simplest to specify that the test will be run on a wire to water efficiency basis with all losses charged against the pump and with instruments to be provided by the purchaser, but the manufacturer

afforded the opportunity of furnishing his own instruments for check purposes.

In making the test, the first requisite is an accurate means of determining the output of the pump. Equipment used includes Venturi, displacement, or orifice type meters, weirs, or free discharge into a reservoir or basin where the volume of water can be accurately measured.

The total head is generally easy to compute. Discharge pressure (including friction) can be measured with a pressure gauge which, however, should be calibrated both before and after tests. The distance between the water level and the pump discharge is usually measured by use of the air column.

INDICATING WATT METER FOR MEASURING IN-PUT

When it comes to measuring the electrical in-put to the motor, the average operator has to call in the local power company. If the power company has a separate watt hour meter for the unit, a rough check can be made by obtaining from the company the constant of the meter and counting the revolutions of the disc. This method is not truly accurate because meters of this type, like water meters, are apt to vary from one to two per cent from true accuracy. There is also some wire loss between the meter and the motor. The accurate way to measure the electrical in-put is to put an indicating watt meter on the motor leads.

In testing a pump we run up against the rule of the Hydraulic Institute that forbids pump manufacturers to guarantee sustained efficiency. This ruling is based on the idea that pumping sand or other abrasive material will reduce efficiencies and that pump maintenance may be faulty. There is something to be said for the manufacturer's side. But it puts us on the spot because on almost every job we are told by Manufacturer A that his competitor's pump may show a better initial efficiency but that this will drop and his own pump will show much better efficiency in the long run. We feel that he may be right, but how are we going to make sure unless the manufacturer agrees to a test being run after the unit has really been broken in.

The writer's own specifications call for the operation of the pump for at least twenty-four hours before the test run of twelve hours shall be made. I would much rather see the pump run for at least a couple of weeks before the test, however.

The part of the specifications governing the test should give the contractor the right to make any necessary alterations or repairs to his equipment to bring it up to the guaranteed efficiency. It should, however, limit the time available for work of this kind to not over three months.

If the pump does not develop its guaranteed efficiency or if it should vary more than five per cent in capacity from that guaranteed, the purchaser should have the option (after giving the manufacturer a reasonable time to make adjustments) of either rejecting the equipment entirely or of accepting it at a reduced price, this reduced price to be stated in the specifications and to be based on the estimated additional cost to the purchaser of furnishing power for a reasonable period in the future, say three years.

The pump manufacturer has made available to us a complete and varied line of efficient and serviceable units. It is our duty as water works operators and engineers to select intelligently from this extensive line the right pump for our own particular needs.

NEW PUBLICATIONS

Manual for Water Works Operators.* By E. W. STEEL.

This manual is excellently prepared by the Manual Committee. It deals with general problems and their specific reference to conditions in Texas. Covering as it does the many phases of water supply, including source, pumping, distribution and storage together with water treatment, softening, corrosion and industrial problems, it is of particular value not only to the plant operator but to the water department superintendent as well.

Several features are worthy of mention. The use of the term safe instead of pure water is to be commended. The definition of polluted and contaminated waters is timely and the requirement of a sanitary inspector on the water shed is of vital importance not usually recognized.

The tolerance of recreational use of reservoirs while particularly adapted to the localities in question is not considered good practice in general.

The discussion concerning the capacity of the distribution system and description of pumping units and secondary sources of power is helpful. The description of main disinfection is of practical advantage. The suggestion on page 113 that 0.5 p.p.m. of turbidity is satisfactory for filtered water is higher than usual. It is believed that practice will adopt this concentration for the state, giving this statement as the background. If this is not intended it should be corrected in a subsequent edition.

It is believed that Chapters 9 and 10, discussing the relationship between treatment and methods and the purification plant, could be advantageously combined. It is to be questioned whether Chapters 16 and 17, describing testing methods, are pertinent since they duplicate Standard Methods. This also applies to particular paragraphs

*Prepared by the Texas Water Works Short School; Editor in Chief, E. W. Steel, Prof. Municipal and Sanitary Eng., Agricultural and Mechanical College of Texas. Manual is distributed by V. M. Ehlers, Texas State Department of Health, Austin, Texas; 1938, price $2.00.

such as those on the threshold odor test, the free carbon dioxide test, etc.

An error is noted on page 3: "whereas there is no generally accepted test to prove presence or absence of disease bacteria." This is misleading since such tests are made daily. The statement should be modified to explain the routine test for *Esch. coli* in its relation to the difficult test for *B. typhosus*. This is meant, but as now stated is confusing. On page 123 the word vapor should be used instead of steam. It is difficult to visualize steam at 65°C.

Chapter 18, a résumé of sanitary standards, is very pertinent and timely. It is of especial value in that this publication appears to be the only one in the field which gives a discussion of the health requirements for a water supply.

The book is very worth while. It should be made available to the general public by purchase. Its influence upon water plant operation and also upon water department control in Texas should be great. The Manual Committee deserves much praise for its undertaking and fine piece of work.

EDW. S. HOPKINS

ABSTRACTS OF WATER WORKS LITERATURE

Key. 29: 408 (Mar. '37) indicates volume 29, page 408, issue dated March 1937. If the publication is paged by issues, **29:** 3: 408 (Mar. '37) indicates volume 29, number 3, page 408. Material inclosed in brackets, [ ], is comment or opinion of abstractor. Initials following an abstract indicate reproduction, by permission, from periodicals as follows: *B. H.—Bulletin of Hygiene (British); C. A.—Chemical Abstracts; P. H. E. A.—Public Health Engineering Abstracts; W. P. R.—Water Pollution Research (British).*

FINANCE

The Problem of Revenue Bonds. FREDERICK L. BIRD. Nat. Munic. Rev. **27:** 304 (Jun. '38). Definition: "A revenue bond is an obligation of a governmental unit, issued for financing the acquisition, construction or improvement of a revenue-producing enterprise and payable exclusively from the revenues of that enterprise". Initiation of such bonds in U. S. goes back nearly a century to Philadelphia Gas Works. Some 50 yrs. ago City of Spokane, Wash., issued water certificates payable solely from water revenue. Ensuing litigation led to legislation by state of Washington in 1897, authorizing use of revenue bonds, said to be first general authorization of the kind in this country. Advantage of it was taken in Washington, notably at Seattle and Tacoma, to finance water, light and street railway systems. Some other cities followed suit. In the 1920's special municipal improvement authorities were created to construct and operate various works, with no powers of general taxation, but with authority to impose service charges and issue bonds payable solely from revenues. Since the depression, Federal aid to revenue-producing enterprises has stimulated state and local revenue bond issues. It is thought that regardless of Federal aid revenue bonds will be continued. Such bonds tie in with problems of debt limitation, taxation and administrative efficiency. They meet antiquated restrictions on borrowing, help avert taxpayer opposition to water, light and other undertakings and tend to more efficient management. They aid financing, where general municipal credit is weak. They are not justifiable to avoid reasonable debt limitations. [Some cities owning water works have long been required by law to meet all costs of the service, including bond charges, from water revenue, but nevertheless the bonds have been a lien on the city as a whole.]—*M. N. Baker.*

The Basis of Municipal Credit. FREDERICK L. BIRD. Minnesota Municipalities **23:** 603 (Oct. '38); Municipal Finance (Aug. '38). *Paper before Municipal Finance Officers, U. S. and Canada.* Soundness of city credit rests on confidence that obligations are within economic resources, sound plans for debt payment, legal authority to draw on community resources, maintenance of livable community, able and honest city administration. [Discussion of

general principles with no attempt to set up arbitrary standards. Does not take up water and other public utility debts financed wholly or partly from revenue.]—*M. N. Baker.*

Is Municipal Government in for a Headache? CARL H. CHATTERS. Minnesota Municipalities **23**: 376 (Nov. '38). Chief financial problems confronting American cities arise from forces outside city halls: (1) unemployment relief and other social security programs; (2) temptation to insure long term debt to get "easy" money under present low interest rates; (3) growing list of tax exempt properties; (4) imposition of added activities on cities without compensating revenues; "nomadic" tendency of industries, which move away after a city has laid pavements and sewers for their benefit, perhaps leaving employees jobless, at the same time imposing tax burdens on cities to which they move. Looming up in future are probable federal taxation of municipal salaries and bond interest, tax exemptions on housing and other federal aid projects. A major battle ground of the next five years will be the use of profits of municipal water, light, power and other utilities to reduce or supplant taxation. "In many cases the taxless towns or cities using large utility profits in place of taxes are fooling themselves, being unfair to the utility consumers and rather too kind to certain property owners." Administrative and technical development are far beyond willingness to accept them on the part of legislative and administrative officials and citizens at large. "A perfect product lying idle in the laboratory or factory does no good. It must be sold. So must the desire to use the best devices for the conduct of an efficient democracy." [Water works men will appreciate Chatters' remarks on milking utilities to reduce general taxation. This is all too general. Besides putting an unfair burden on water-rent payers it is liable to result in curtailing appropriations for both up-keep and extensions. Every tub should stand on its own bottom.]—*M. N. Baker.*

Method Used to Finance Main Pipe Extensions in the Hartford, Conn., Distribution System. WARREN A. GENTNER. J.N.E.W.W.A. **52**: 178 (Jun. '38). The 3 methods of financing ordinary dist. system extensions used in Hartford are reviewed; (1) from 1853 to '61 all extensions were financed from water revenue, (2) from '61 to '22 extensions were made through an annual income guarantee by consumers of 10% of the extension's cost, (3) assessment plan in use since '22. Plan 3 adopted because of dissatisfaction to 10% plan which, while it shifted portion of financial responsibility to consumer directly benefited, did not provide for proportioning this responsibility over all consumers receiving water from extension and was unfair to dept. because of failure to provide for continuity of payment in event of change of guarantor's property, moving from city or death. Original assessment plan provided for (a) Cost base which was av. cost of 6″ pipe lines for previous yr. provided this not higher than actual cost of extension, later changed to av. cost of 6″ pipe in previous 5 yrs., and in '30 to cost of 8″ pipe; (b) assessed cost against each ft. of property frontage equalled cost of laying main divided by total frontage, changed in '25 to division by total frontage less exemptions; (c) assessment

payable on work's completion or in 10 annual installments with 6% annual interest, later changed in '30 to 4 payments in 4 yrs; (d) assessments became liens on property; (e) exemption up to 75′ on corner lots with mains in service along other frontage, increased in '29 to 125′. In 17 yrs. use of plan, 76.2% of total value of work done ($1,686,621) was billed to abutting property owners ($1,284,641) leaving 23.8% to be financed by water dept. Of amt. billed 89.7% paid, 2.9% lost and transferred to suspense acct. Interest rec'd. on unpaid balances amounted to approx. 4.3% of total capital investment. Depression conditions brought about use in some cases of modified plan called "supply main method" in which connection charge or fee made on connection to main. Modified plan aids in defraying costs of some mains laid for good of service without burdening occasional consumers. Assessment plan has produced most satisfactory results of any plan tried.—*Martin E. Flentje.*

Rural Sanitation. WESLEY E. GILBERTSON. No. Dak. Wtr. & Sew. Works Conf. Off. Bull. **6**: 1: 8 (Jul. '38). Author states that as 84% of the population of North Dakota is rural, means for water supplies and sewage disposal must be largely provided individually at a relatively higher cost rather than collectively. Outstanding obstacle to real progress in rural sanitation is an economical one, augmented by the handicaps of inadequate organization, relative isolation, and imperfect education.—*P. H. E. A.*

Financing Small Rural Water Undertakings. ANON. Technique Sanitaire (Fr.) **32**: 48 (Feb. '37). The Department of Jura has under consideration financial aid on a graduated scale to needy communes for the purpose of acquiring water supplies. A further proposal is that in order to secure funds on better terms several departments should associate themselves into a financial unit for credit purposes. A resolution with similar objects in view has been passed by the Ligue générale pour l'Aménagement et l'Utilisation des Eaux. Such enterprises would aid in fighting the depression.—*Frank Hannan.*

Fixing a Meter Rate Schedule. REEVES NEWSOM. W. W. Eng. **91**: 1212 (Sep. 14, '38). To insure rates providing proper revenue municipally owned plant must decide on policy regarding replacement and retirement whether to be on a pay as you go basis or to be done through future refinancing. Investment of 25%–40% of total, chargeable to fire service should be considered in fire charges. Min. charge, various types of schedules to meet varying conditions, and recommendations for thorough study in setting up schedule discussed.—*Martin E. Flentje.*

Enforcing Payment of Water Bills. DANIEL M. SULLIVAN. J.N.E.W.W.A. **52**: 244 (Jun. '38). To reduce deficits of past 7 yrs. and to collect some of the $2,000,000, in delinquent bills, reorganization of Boston Water Dep't. has been undertaken to bring all under closer control. Drive to collect outstanding bills and enforcing collection of current bills carried on with considerable success. Methods of billing and making shut-off notice discussed.—*Martin E. Flentje.*

PUBLIC RELATIONS

Impressions. F. P. FISCHER. Ann. Rept. Ohio Conf. Water Purif. **17**: 127 ('37). Water works chemists, through familiarity with laboratory work, should not overlook av. non-technical individual's conception of a chemist. Visitors to the laboratory arrive in much the same frame of mind as when going to a museum or to see a magician. They expect to see a surgically-clean maze of odd-shaped bottles and devices, supervised by learned-looking individual in a white gown, and if what is expected is not in evidence they are disappointed. It is to the advantage of the chemist to arrange and conduct his laboratory so as to demand respect, if not the awe, of visitors. This will do much to advance the standing of the chemist in the community. Visits of organizations to plant and laboratory should be encouraged and on such occasions the laboratory and personnel should be on dress parade.—*R. E. Thompson.*

The Municipality and Its Water Supply. WM. C. EMIGH. W. W. and Sew. **84**: 405 (Nov. '37). A general and non-technical discussion of the relation of water supply to the community. Writer suggests that following points may prove valuable to the water works man in popularizing the water works: Water works history contains much of interest, examples are given. American consumers expect and get an ample supply. Fire protection places heavy demands and responsibilities on the water works. Water supply is a vital link in the public health chain which includes sewage treatment, inter-community relations, and waste reclamation in certain industries. Potable water, as much a manufactured product as steel, requires trained personnel for production. Chlorine quantities are minute, bearing relation to the water treated that $\frac{1}{8}''$ bears to 5 mi. Cross-connections are a very real hazard to public health. Water works are now inaugurating taste and odor elimination and softening, and these affect both consumer and industry. Rapid progress being made in pumping efficiency and rate scheduling.—*H. E. Hudson, Jr.*

The Good-Will of the Public—The Strength of a Water Utility. ANON. Am. City **53**: 8: 65 (Aug. '38). Among means taken by the Peoples Water Service Co. of Brunswick, Georgia to promote friendly relations with their customers is to notify them of excessive meter readings so that any leaks can be repaired immediately. Notice is received before bill for increased consumption is sent out. Also, meter reader helps cashier to make up bills. This is an advantage because meter reader is then in a position to answer customers' complaints more intelligently.—*Arthur P. Miller.*

Fairness Must Characterize Consumer Relations. LEO T. PARKER. W. W. Eng. **91**: 1414 (Oct. 26, '38). Water dept. or company is bound to use reasonable care that water supplied be ordinarily and reasonably pure and wholesome; this principle applies when supplying water for use in plumbing systems, equipment, and other appliances. Case cited where damages avoided for damage to fixtures by sand from pressure filter. Courts require consumers to act reasonably and cooperatively, must pay reasonable rate and refusal to do so entitles water purveyor to shut off water.—*Martin E. Flentje.*

Legal Liability for Supplying Contaminated Water. ANON. Health News, N. H. State Board of Hlth., p. 5 (Feb. '37). In an action against a city charged with supplying contaminated water, the court rendered judgment in favor of plaintiff. Decision upheld by Supreme Court on appeal. Defendant city maintained cross connection to nearby river for fire protection emergency. Plaintiff established that the river water was carried into the domestic system and that the river water was polluted with *Esch. coli*. He alleged that typhoid bacilli are to be expected where coliform bacilli are found. This judgment was given even though it had not been shown by direct evidence that the river water was polluted with typhoid bacilli.—*P. H. E. A.*

Lead Poisoning and Water Supply. ANON. Off. Cir. Br. W. W. Assn. **20:** 517 (Aug. '38). Decision was confirmed in Court of Appeal whereby damages against water undertakers were awarded for lead poisoning. Water was plumbo-solvent but water undertakers had not warned consumers that they must take precautions and not use lead service pipes. There were about six cases of plumbism in population of 16,000 between '29 and '35, after which installation for hardening water was installed.—*W. G. Carey.*

HEALTH AND HYGIENE

Is Routine Examination and Certification of Food Handlers Worth While? W. H. BEST. Med. Officer **59:** 227 ('38). Author, who is Deputy Commissioner for New York Dept. of Health discusses reasons which induced N. Y. City to discontinue the compulsory examination and certification of all food handlers in '34. Briefly the reasons given are—their examination by private physicians is unreliable; the cost of such examination by the Dept. of Health alone would be prohibitive and not worth the public health benefits achieved; the most careful physical examination will fail to reveal important conditions; an effective examination would have to include at least a chest X-ray, a Wassermann test and stool examinations for typhoid, paratyphoid, amoebic and bacillary dysentery carriers and the cost would be prohibitive; no assurance even then is obtainable that the food handler would remain free from communicable disease during the tenure of the certificate; the amount of disease spread by food handlers has been over-estimated. These various points are elaborated. Author considers more valuable results are obtainable through prompt reporting of communicable diseases, by thorough epidemiological investigations and, in particular, listing and controlling typhoid carriers and by the general education on cleanliness methods of all food handlers. [The position now recommended is that adopted by English experts, who have never followed the U.S.A. in advocating these special examinations of food handlers.]—*B. H.* (See following abstract).

Administrative Control of Food Handlers and Places Dispensing Food and Drinks. K. MARDEN, J. M. CURRY, L. J. HOROWITZ AND B. G. HORNING. Am. J. Pub. Health **28:** 1277 (Nov. '38). Discusses experiences at Hartford, Conn., and includes statement as follows: "It has been shown that the routine examination of food handlers by supervisory authorities has had but little effect upon the incidence of disease. Compulsory laws, involving a large

expenditure of money and frequently giving a false sense of security, would not seem to be justified. A number of cities which formerly issued health certificates to food handlers have discontinued doing so. From the standpoint of public health administration, experience indicates that the spread of such diseases as typhoid fever, syphilis, and tuberculosis can be controlled more satisfactorily and economically by investigating all cases and contacts in the community and bringing the sources of infection under control, than by routine examination of food handlers."—*P. S. Wilson.*

Editorial Note. This abstract and the one immediately preceding record a tendency toward a major change in administrative policy in the public health field. It has been the practice in many of the larger American cities for a number of years to subject all food handlers in places open to the public to periodical physical examination. Such control is now being abandoned on the grounds that it is impracticable and that the amount of disease spread by food handlers has been over-estimated. Without debating the validity of such tendency, it is highly important for the water supply and public health engineers to be aware of it while they are considering greater stringency in the control of public water supplies. Those engaged in the production of water supplies are not unmindful of their responsibilities. They are aware that, in typhoid fever death rates, the reduction has been so great as to indicate that major steps have been taken in urban control of milk and water supplies and reduction of fly nuisance as well as other environmental factors contributing to the spread of this disease. They are at the same time aware that sporadic and city-wide outbursts of illy-defined dysenteries are recorded from various cities at various times. They are aware that the normal tendency is to consider the public water supply the vector of such infections. It also appears that even while the nature of these disorders yet remains not clearly defined from the standpoint of the clinician and, while the relation of public water supply to the disorders often is inferred rather than definitely demonstrated, there is a tendency on the part of some public health engineers to make more rigid the structural and performance standards for production of all public water supplies. In some instances, methods of construction of water works properties are being advocated upon a basis which appears to assume the simultaneous breakdown of all lines of defense and the necessity to build and operate upon this basis rather than upon the normal probabilities with a reasonable factor of safety. In view of the acceptance of certain practical aspects of the control of food handlers by public health administrators, and the conclusion that the food handler is less the vector of disease he was once presumed to be, it may be proper to approach new codes of water supply construction and performance practice with a similar degree of realism. —*H. E. Jordan.*

An Ice-Cream Food Poisoning Outbreak Due to B. dysenteriae (Sonne). W. SAVAGE. J. Hygiene **38**: 331 ('38). The outbreak involved about 130 cases and was of scattered character, cases being in five different sanitary areas. Clinically it was mild in character with no deaths. Symptoms were abdominal pain, vomiting and diarrhoea lasting about four days; stools often blood-stained and contained mucus. Incubation period varied from less than 24 hrs.

up to 2 days. Inquiries showed that all the primary cases were infected on two days, i.e., May 17 and May 23, '37, from ice cream purchased from one particular vendor. A number of later secondary cases occurred but 34 were infected on May 17 and 84 on May 23. The ice cream was made on premises which were entirely unsuitable, while facilities for cleaning utensils were most inadequate. Milk and other ingredients were used raw, but the milk could be exonerated as a cause of the infection. A man and his wife were the only persons in the business and both denied any previous illness. On the bacteriological side Sonne dysentery bacilli were isolated from several cases and the blood serum of five patients examined gave positive agglutination with the bacillus (1:125). The ice cream was not examined until May 25, but then showed no dysentery or Salmonella organisms but heavy contamination with *Esch. coli*. Only a single late feces sample was obtainable from each vendor and both failed to show dysentery bacilli. While infection from a carrier seemed likely no proof was obtainable.—*B. H.*

Suitable Paper Wrappers and Containers for Foods. J. R. SANBORN. Amer. J. Pub. Health. **28:** 571 ('38). Unless special precautions are taken paper containers may contain many sporing and slime-forming bacteria which are not killed by the steam-heated drier rollers. Fundamental requirements for production of sanitary quality paper are a pure process water, virgin pulp from sound clean wood, handling throughout under sanitary conditions, and care of the manufactured product before and after making up into containers. Tentative standard of 500 colonies per gram of disintegrated container board has been adopted by the author. Use of old used materials such as old board, waste paper and rags is unsatisfactory. With present satisfactory paper milk containers the chief sources of microbial contamination are the paper stock and manual contact. A single rinse with 10 cc. of sterile water and plating on agar gives a sufficiently reliable index of bacterial purity. Average counts are usually less than 50 per container.—*B. H.*

Microbial Flora of Paper Containers. F. W. TANNER. Amer. J. Pub. Health. **28:** 587 ('38). Discussion of glass and paper containers and comparative bacterial contents of each type. Methods of examining milk bottles and paper milk containers are considered and author finds that a rinse test is best for routine purposes. Over 90% of paper milk bottles examined yielded no bacteria to sterile rinse water when examined by standard methods. All organisms found were harmless saprophytes. *Esch. coli* not found in over 1,200 paper bottles. All examinations were, however, with one type of bottle, made from virgin wood. Author considers that water-proofing the paperboard with hot paraffin contributes a marked reduction in viable bacteria.—*B. H.*

The Relation of Infectious Diseases—Excluding Enteric Fever—to Water, Especially Drinking Water. H. BRUNS. Chem. Z. **62:** 469 ('38). *Paper before Water Chemistry Sect. Verein Deutscher Chemiker, June '38.* Discusses epidemics which may be due to water, including cholera, paratyphoid, non-specific intestinal diseases, anthrax, spirochaete diseases, worm diseases,

tularemia and amoebic dysentery. Conjunctivitis and other diseases may be transmitted by bathing waters. Conditions affecting the transmission of disease by water, e.g. pollution by the excreta of carriers, and the longevity of pathogenic organisms in water. Water supplies are generally infected before entering a water works, but infection may also occur at the pumping station or in the distribution system. Chlorination is a protection against all water-borne diseases with the possible exception of anthrax. Frequent bacteriological analyses of samples of tap water must be made to detect pollution in the distribution system.—*W. P. R.*

The Typhoid Fever Carrier Problem. ANON. Calif. State Dept. of Public Hlth. Weekly Bull. **16**: 38: 149 (Oct. 16, '37). In this article, which is continued from previous issue, the writer urges utmost care in dealing with suspected or known carriers. Emphasized that a positive stool may result after several negatives. A known carrier should comply with an agreement whereby he does not publicly deal with food or beverages which might serve to extend the disease. It is further stressed in this article that it is very difficult, if not impossible, to cure a carrier. Various operations have resulted in a cure in about three-quarters of the cases which were selected. It would not be advisable to operate unless gall bladder or bile trouble was evident.—*P. H. E. A.*

Progress Against Typhoid Fever. ALBERT C. EDWARDS. Hlth. Bull., State Board of Hlth., Wisconsin. **6**: 9 (Jan.–Mar. '38). Typhoid fever has decreased from the fourth most frequent cause of death to one of the rare causes in Wisconsin. This disease due to improved sanitary facilities, both urban and rural, and proper identification of typhoid carriers. Should be possible, however, to eliminate the disease still further by increasing attention to sanitation and typhoid carriers.—*P. H. E. A.*

Safeguarding the Purity of Public Water Supplies. D. H. THOMSON. Wtr. and Wtr. Eng. (Br.) **40**: 478 (Sep. '38). History of past typhoid epidemics shows that infection due to typhoid patient or carrier is far more dangerous than sewage pollution. Where water is supplied without treatment constant watch by frequent analyses should be kept. Where chlorination already practised treatment should be automatically controlled and continuously recorded. Many underground sources are in areas populated or developed agriculturally and therefore subject to risk of pollution from cess pits, manure heaps, leaky sewers and natural swallow holes, and these necessitate some precautionary measure. While alterations to existing wells are made, ideal is to cut them out of supply or to chlorinate. Cleaning filter beds or service reservoirs necessitates strict supervision of workmen and adequate lavatory accommodation to prevent nuisance, reservoirs being swilled with chlorine water before refilling. In distribution systems repairs and new connections should be made under pressure to avoid in-suction of contaminated water, and screw down hydrants should replace ball hydrants. New mains should be chlorinated or flushed out periodically for a week. Much diversity of opinion exists as to medical examination of waterworks staff to eliminate typhoid

carriers, record of British water supplies shows no evidence of need, although many have expressed themselves in favor of precaution. Recognized control of water purity is by analysis but there is unavoidable interval between sampling and results. Only real safe procedure is some system of routine purification such as chlorination or ozone treatment possibly in addition to filtration. —*W. G. Carey.*

Water-Borne Typhoid. D. FORBES. Lancet, p. 567 (Mar. 5, '38). Summarizes briefly the chief facts of 17 water-borne typhoid outbreaks occurring from 1879 up to and including the Croydon outbreak in '37. Recommends study of the L.G.B. and Ministry of Health reports on these and suggests that their perusal is likely to be reassuring. Medical Officers of Health should regard it as their duty to keep informed as to the precautions actually taken to prevent pollution of the water supply and from time to time consult with the Water Engineer and review the position. Considers it impossible to say how often well water should be tested bacteriologically since much will depend on local circumstances, but chlorination should be insisted on if men are at work in the well or its headings; when there is reason to believe that leakage from cesspools or drains can find its way quickly into the well; or if monthly examinations show the persistent presence of coliform bacilli in 100 ml. and their presence at times in 20 ml. or less. When men are working in the headings carriers should be excluded as far as possible by blood tests and repeated examination of feces and urine. Before descending the shaft workers should use pail-closets placed on cement floors and the pails emptied at a safe distance. Gum boots should be put on just before descending. Provision should be made for urination at the bottom of the shaft, at intervals in the headings, and near the site of work. Urine should be collected and brought to the surface in pails with tightly fitting covers. No smoking should be allowed underground as this encourages spitting. Workers should be warned of danger from feces and urine and should individually sign a pledge not to defecate in the headings.—*B. H.*

Prevention of Water-Borne Epidemics in Connection with the Ohio River Flood. H. W. STREETER. Ann. Rept. Ohio Conf. Water Purif. 17: 79 ('37). Problems and emergency measures in Cincinnati during flood and part played by U.S.P.H.S. water pollution research laboratory are discussed. Noteworthy feature of flood was relative freedom from typhoid and other water-borne diseases. Widespread and continued warning to boil all drinking water was most effective single measure adopted. Tests revealed rapid deterioration in sanitary quality of water remaining in Cincinnati distribution system at widely distributed points, suggesting progressive contamination, probably from back-siphonage from toilet fixtures, seepage of ground water through minor main leaks and back-leakage through cross connections. Chief reliance placed on heavy chlorination, 2–5 p.p.m., for protection of auxiliary supplies used. Householders advised to chlorinate all water stored about premises for general uses. Pouring of contaminated water into toilet flush tanks having fixtures of back-siphoning type could very readily cause direct infection of public water system. Typhoid vaccination instituted as rapidly as possible.

This measure afforded little or no protection to those exposed shortly after onset of flood but undoubtedly was effective during "clean-up" and against secondary infections. When operation was resumed, fresh water pumped into system was heavily chlorinated and citizens were warned to continue boiling water. After 9 days, safe residual was observed at all points. In general, water containing over 0.2 p.p.m. residual chlorine was found free of coliform bacteria, but in few cases these organisms were present in water containing 0.2–0.3 p.p.m. chlorine. Paper concludes with review of temporary measures available for minimizing hazards in such emergencies and permanent safeguards. *In discussion,* F. H. WARING stated that during Aug. typhoid epidemic in Portsmouth, caused by contaminated milk, only member stricken in one family of 10 was one who was absent during flood and did not receive immunization treatment. This confirms experience during Salem epidemic in '20, when there was entire lack of typhoid among men immunized during war.—*R. E. Thompson.*

Story of a Water-Borne Epidemic of Gastro-enteritis at Vinton, Ia. CARL F. JORDAN AND CHARLES D. MULLINEX. W. W. Eng. **91:** 1441 (Oct. 26, '38). Estimated 2000 cases gastro-enteritis in epidemic at Vinton, Ia. between Feb. 2 and 7 or 8, '38. Apparently due to city water supply obtained from deep wells, 1280′ to 1505′ deep; with hazards of old surface res., well showing contamination, cross-connection between city and raw Cedar R. industrial supply, and a 1000 g.p.m. fire pump connected to both res. and river. Hazards to be eliminated and 1 new well put down.—*Martin E. Flentje.*

Typhoid Fever in Puerto Rico. JUAN BASORA DEFILLO. Puerto Rico Health Bull. **11:** 2: 80 (Feb. '38). Typhoid fever not a major public health problem in Puerto Rico at present time. Death rate from this disease in the Island has decreased considerably during years '10–'35 incl. The disease is mainly a rural problem because of difficulty of establishing and maintaining strict sanitary measures in rural districts. Outbreaks traced to infected milk, ice cream or uncooked vegetables very rare and almost unknown in Puerto Rico due to habit of boiling milk and cooking vegetables before use. Epidemiological evidence in four outbreaks cited. Bur. of Epidemiology and Vital Statistics has four trained inspectors continuously giving antityphoid inoculation in rural sections of the Island, especially in those where endemicity has been high in past.—*P. H. E. A.*

Endemic Typhoid Fever in the Department of Gironde. G. DUBREUIL. Gaz. hebd. Sci. Méd. de Bordeaux **59:** 442 ('38). The paper is primarily based upon notifications in '37. There were 215 notifications in the Department. Maximum was in May with 44 notifications. In Bordeaux itself 73 notifications were received. The attack rate works out at 28 per 100,000 for the City of Bordeaux, 23.6 for the suburbs, 24.2 for the rural districts and 25.3 for the whole Department. Some details of local distribution given. Although the local water supplies, particularly in the rural districts, are frequently unsatisfactory, it is remarked that the zone in which water supplies are best controlled provides the largest number of cases. Hence the conclu-

sion is drawn that the endemic level of typhoid fever in the Gironde is determined by other factors than the water supply.—*B. H.*

On Bacillary Dysentery and the Gastro-Enteritic Form of Paratyphoid B at Amsterdam. A. CHARLOTTE RUYS. Maandschr. v. Kindergeneesk. **7**: 285 ('38). Frequency of the gastro-enteritic form of paratyphoid B in Amsterdam is shown by fact that 133 cases were notified to the Dutch Ministry of Health in '37. In 82 it was possible to determine probable cause of infection, viz., duck soup in 24 cases (5 families), ducks' eggs in 24 (7 families), pigeons' eggs in 2 (1 family), eels in 3 (1 family), steamed mackerel in 22 (9 families), and minced mackerel in 7 (3 families). In 51 cases belonging to 29 families source of infection could not be determined. The erroneous opinion that bacillary dysentery only occurs in the summer months leads to mistaken diagnosis of intestinal influenza in which the faeces are overlooked as source of infection, and special precautions are neglected. This had repeatedly given rise to an unnecessary accumulation of dysentery in the winter.—*B. H.*

Drinking Cups and Drinking Fountains. ANON. Conn. Hlth. Bull. **52**: 1: 24 (Jan. '38). A revision of the State Sanitary Code effective Dec. 15, '37, provides that for drinking water facilities in schools, hotels, factories, stores, theaters and other places to which the public has access, not only must individual drinking cups or drinking fountains be provided, but such drinking fountains must be sanitary: with slanting jets so water cannot fall or be forced back on point of discharge; with guards to prevent contact with the nozzle by nose or mouth; with jet and all openings in the water supply issuing above the level of the fountain bowl; with adequate bowl drainage so as to prevent fouling of the bowl; with a trapped connection if draining to a waste pipe; and with a sufficient size waste opening (with strainer) and pipe to carry off water promptly.—*P. H. E. A.*

CROSS CONNECTIONS—PLUMBING HAZARDS

Cross Connections in Plumbing Systems. ROY B. HUNTER, GENE E. GOLDEN AND HERBERT N. EATON. J. Research Nat. Bur. Standards **20**: 479 (Apr. '38). Deals with the technical aspects of the problem of preventing back-siphonage from plumbing fixtures into water-supply systems. Classification of cross-connections is made and various terms defined. The conditions to be considered in studying vacuum formations in water pipes are discussed. Mathematical analyses are made of flow of air, terminal velocity of water falling in a vertical water-riser, and the terminal height. A few experimental measurements are presented to check some of the theory. The critical velocity of air flow is pointed out and it is shown that the negative pressure equal to approximately .5 of atmospheric pressure will cause maximum air flow through any given size opening. Experimental data by Zinkil on safe air gaps is analyzed and an equation developed for minimum air gap for various sizes and types of faucet openings. Siphon preventors are discussed from standpoint of air flow and a criterion of their effectiveness is derived. The operation of stable and unstable flush valves is analyzed and

the conditions of stability are outlined, assuming perfect operation of the valve at all times. Analysis is made of two general methods of preventing back siphonage, namely, prevention of vacuums in water pipes and protection at the individual unsafe fixture. Merits of each method are discussed; however, no definite conclusions are given. In conclusion, authors point out some practical considerations that will have to be given attention before the results can be applied.—*A. A. Kalinske.*

"Cross-Connections" and the New Law Providing for State Plumbing Regulations. Health News, N. H. State Board of Hlth. **15**: 6: 13 (June '37). New legislation effective July 27, '37, empowers the State Board of Health to adopt a code of plumbing regulations of state-wide application. Object of this legislation was to empower the Board to regulate adequately types of cross-connections of an unusual nature, and not specifically covered by the former existing statute. The text of the law is given.—*P. H. E. A.*

Checking Indoor Water Pollution. LESLIE K. SHERMAN. Conn. Hlth. Bull. **52**: 2: 43 (Feb. '38). State Health Dept. has started an inspection program in coöperation with local departments. "Minimum Requirements for Drainage and Toilet Systems" is quoted. In Hartford, 96 buildings inspected. At 10 locations tanks were not properly safeguarded. Two drinking water cooling tanks were uncovered and located under sewer lines. 33 of the 96 places had water storage tanks for other than sanitary purposes, some had submerged inlets. The surveys indicate the need of not only delivering safe water to a building but also of keeping the water safe after it enters the building.—*P. H. E. A.*

Cross-Connections. A. J. SMALSHAF. Drippings from the Georgia Faucet p. 10 (Jan. '38). The principal economic reasons for existence of cross-connections between public and private water supplies are given with conclusion that health is basic and economic advantage should not be considered if hazards exist. The Wolman and Gorman report is quoted to show that, during the period '20–'30, cross-connections ranked first as cause of typhoid with 8,000 cases and 226 deaths. Methods of providing adequate safeguards without absolute elimination of cross-connections are discussed. Hidden cross-connections frequently exist and constitute a health hazard. Water dept. and state health officials should jointly solve the problems of cross-connections.—*P. H. E. A.*

On the Construction, Operation and Use of Air-Valves. EDUARD BAESE AND FRIEDRICH LUNING. Gas-u. Wasser. **81**: 420 (May 28, '38). Water distribution systems have to be correct from the hygienic as well as from the technical standpoint. Cross-connections with impure water supplies as well as siphons that draw back polluted or warm water must be avoided. Low pressures that cause back siphoning can either be formed inside of buildings or in the main. In both cases the unsanitary effect can be avoided in principle by use of air-valves. Construction of several types of air-valves is given and

also results of tests of their efficiency. Noted that many commercial types have not enough opening for passage of air, which should be at least as large as the cross-section of the pipe. A seal of metal on metal may start leaking through corrosion. Seal of metal on soft rubber may stick and not operate on a slight change in pressure. Seal of soft rubber on hard rubber gave satisfaction. Tests on house installations showed large air-valves at ends of riser pipe more efficient and more easily controlled than small air-valves on each tap, provided branch line leaves the riser pipe above the top of the basin served. But even so it was not possible to fully avoid any occurrence of back siphoning and therefore installation of check-valves at the meter was studied. Several types of check-valves are described and results of their efficiencies given and their effect on the meters and in the formation of water-hammer is noted. The combination of air and check-valves is recommended.—*Max Suter.*

METERS AND SERVICES

How Hartford Increased Its Meter Revenue. SHERMAN L. ROGERS. W. W. Eng. **91**: 1206 (Sep. 14, '38). To obtain max. advantage of meter, it must be large enough to pass max. flow, not cause loss of too much pressure, be sensitive to smallest flow, and kept in good mechanical condition. Hartford Co. with pop. of 245,000 has 28,091 meters; $\frac{5}{8}$″ to 1″ meters tested every 5 yrs., 1½″ every 4 yrs., 2″—3 yrs., 3″—2 yrs. and 4″ & 6″ meters yearly. Meter master recorder has shown smaller meter can be used in some cases with increased revenue resulting. New fire line "tell tale" developed, has shown itself reliable and useful.—*Martin E. Flentje.*

Louisville Meter Practice. ANON. Eng. News-Rec. **121**: 324 (Sep. 15, '38). Of 5,743 small meters which passed through shops during last 8 months of '37, almost 6% registered less than 90% of flow of 1 g.p.m., 11.8% registered 90–98% and less than 77% registered with required accuracy. When meters are changed, policy is to reduce size to that required by demand rate and to install batteries of meters in place of single large units. Latter practice results in greater accuracy, lower initial and maintenance costs, and permits repairs without complete interruption of service.—*R. E. Thompson.*

Rotary Meters. Materials Used in Their Construction. ANON. Wtr. and Wtr. Eng. (Br.) **40**: 470 (Sep. '38). Metals with high corrosion resistance are employed only for the more important operating parts in contact with the water and on which the life and accuracy of the meter depend. Turbine and displacement meters represent the two principal types in common use, and these are further subdivided into the "dryface" and "wetface" types. In the former the submerged mechanism may be of pure nickel and in the latter all internal mechanism may be of pure nickel. It has been found that many waters attack brass causing rapid wear of gear teeth. Nickel, and to a lesser extent, monel metal have now displaced brass. The use of pure nickel in conjunction with proper gear wheel design can be guaranteed to give excellent service life.—*H. E. Babbitt.*

Water Service and Repair Trucks in Los Angeles. HAROLD J. MARTIN. Am. City **53**: 6: 41 (Jun. '38). Los Angeles, with 4000 miles of water pipe and conduit and 274,000 active meters, has a tremendous maintenance job. This is facilitated by new types of service trucks recently placed in operation. The new meter and service installation truck is of sheet metal, almost entirely welded, on an angle-iron frame. The curb side of the truck has outside compartments for frequently-used tools, dies and the like. A vise swings out of one and a bracket to support the pipe in the vise out of another. On the other side, are boxes for pipe fittings and other tools. Bars and long tools are carried in a transverse bin. In the truck, there is a pipe tunnel, kerosene tank and a boot box under the upholstered front seat. The water main repair truck is of the same general construction as the other one except that the body ends in a short rear deck with removable panel sides and on which is mounted a davit crane. This truck is also equipped to operate a back filler. The trucks were designed and built by the General Plant Division of the Bureau of Water Works and Supply.—*Arthur P. Miller.*

Setscrews Take Strain Off Corporation Cocks. ANON. Eng. News-Rec. **121**: 296 (Sep. 8, '38). In Los Angeles, 1½″ and 2″ corporation cocks inserted into c.i. mains are made more secure by equipping cocks with special flange on inlet side. Flange is about ⅜″ thick, cast integral with fitting, has triangular periphery and is drilled and threaded for three ½″ bronze setscrews. Two of latter are at the bottom, where bracing is required most. After screwing cock into main, setscrews are backed from flange into tight contact with main, thus providing support for connection. Bracing has been tested and found highly efficient. As added protection, bronze fitting with bell end is screwed on to corporation cock and service pipe is leaded into bell to make flexible joint to compensate for settlement or other deflection in connecting line.—*R. E. Thompson.*

Earthing Electrical Installations to Water Pipes and Mains. ANON. The Engr. (Br.) **146**: 210 (Aug. 19, '38); Civ. Eng. (Br.) **33**: 286 (Aug. '38). Regulations for controlling electrical grounding to water pipes have been approved by a number of interested British organizations. They cover the following principal points: (1) an electrical grounding to water mains is to be used only as a measure of safety and for radio-frequency currents, (2) in making a grounding there shall be no cutting or other injury to the water pipe, (3) the electrical connection shall be of an approved design, (4) notice must be given before a connection is made to a buried water pipe, (5) wherever a water meter exists a suitable bond shall be placed across the meter, and (6) the water authority may test the electrical connection or it may request the responsible electrical authority to make a test.—*H. E. Babbitt.*

The Mechanical Properties of Lead Water Pipe. BRINLEY JONES. Engineering (Br.) **145**: 285. (Mar. 18, '38). Lead pipes which conform to all present demands can, and occasionally do, fail prematurely under certain conditions. "Quick strength" and "creep strength" are associated with fundamentally different properties of the metal and resistance figures obtained in quick hydraulic bursting tests are no guide to the capacity for resisting

prolonged hydraulic pressure. Lead is also susceptible to extreme variations in crystal structure during and sometimes after manufacture, and this determines its behavior under low stresses. The wide range of possible crystalline structure make it desirable to analyse the mechanical properties required in the present use of lead pipes. Found by tests that the finer the grain the greater the creep, the difference being of a large order of magnitude. The creep strength of various alloys of lead is also greatly influenced by the grain size. Unfortunately, however, coarse-grained lead may fail under inter-crystalline cracking. Two commonly encountered causes of failure of lead pipe are creep, and inter-crystalline cracking. The addition of antimony, bismuth, tin, cadmium, tellurium, and other metals to lead increases its stiffness or "quick" strength. In the study of the progressive failure of a "soft" material under stress the development of the ultimate stress is succeeded immediately by a collapse in the load, which then diminishes toward final fracture. The ability to hold some load beyond the ultimate is caused by spontaneous recrystallization, a property possessed by lead and some lead alloys. The ability of lead to resist repeated stresses is not affected by this property. It has been shown that the "fatigue" strength of lead and lead alloys can be materially increased by admitting air to the surface of the test piece, or by alloying it with certain other metals without increasing its hardness. Pipes made from copper-containing metal have an improved margin of safety under pulsating pressure and extraneous vibration.—*H. E. Babbitt.*

Contribution to the Problem of the Destruction of Lead Pipes. L. W. HAASE. Kleine Mitt. Ver. Wasser-, Boden-u. Lufthyg. **13**: 293 ('37). Author considers conditions necessary for the solution of lead in water. The dependence of the solution of lead on the presence of oxygen, the chemical composition of the water and time of contact with the water are mentioned. Reference is made to formation of soluble plumbates with alkali and alkaline earth metals and danger to public health of the solution of lead in water. Destruction of lead pipes may be caused by chemical action from outside, by physical action such as frost and erosion, by stray electric currents, by reactions which depend upon the composition of the lead and are promoted by chemical action from inside or outside the pipe, and by unsuitable laying and use. These types of destruction are explained with the help of photographs. The use of other substances instead of lead for water pipes is considered.—*W. P. R.*

Protection of Water Pipes from Corrosion. A. VIOLET. Metallwirtch., **15**: 1129 ('36); Gas-u. Wasser. **80**: 914 ('37). Corrosion inside pipes may be prevented by suitable treatment of the water to remove or bring into combination free carbon dioxide. Lead pipes are unsuitable for use with water containing much dissolved oxygen, aggressive carbon dioxide, nitrates or chlorides. Copper should not be used in the presence of much carbon dioxide. —*W. P. R.*

DISTRIBUTION MAINS AND RESERVOIRS

Finding Leaks in Water Mains. ANON. Eng. News-Rec. **121**: 431 (Oct. 6, '38). Leak-finding equipment developed by East Bay Munic. Util. Distr., Oakland, Calif., is described and illustrated. Fundamentally, principle

employed is location of leaks by tracing vibrations, in audible range, produced by escaping water. Expts. in '34 led to adoption of vacuum tube amplifiers. Essentially, equipment consists of microphone, amplifier and ear phones. Employment of amplifying devices introduces difficulties in making apparatus selective for particular vibrations set up by leakage. Most troublesome of interfering noises found to have frequencies below 1000 cycles per sec., while vibrations from leaks are usually of considerably higher frequency: hence microphone used has low sensitivity in 1000-cycle range and sensitivity peak at about 3000 cycles. Equipment developed which can be used for exploring leaks in subaqueous pipes. In general surveys, leaks as small as 2-3 gals. per min. have been discovered at depths greater than 10′ below ground surface. —*R. E. Thompson.*

Water-Works Underground Survey by Lima, Ohio. E. E. Smith and W. P. Snook. Am. City **53**: 7: 35 (Jul. '38). This WPA project was started "to provide comprehensive and accurate records of all underground structures; to make possible easy access to such information at more than one place; to inaugurate a system which could easily be expanded and corrected and to obtain a complete inventory of the distribution system for valuation purposes." These aims were evidently accomplished with the completion of a master map, district maps and blueprinted descriptions of underground property at all intersections. The facility with which additions and changes can be made is commendable.—*Arthur P. Miller.*

Protection Against Leakage of Valves. Chr. Hülsmeyer. Arch. Wärmewirt. **19**: 174 ('38). To prevent scoring of sealing edges of valves by accumulation of minute particles along edge at instant before closure is complete, ring of close-wound helical spring is provided which covers opening before closure and filters out such particles.—*C. A.*

Reinforced Concrete Water Towers. Elevated Storage for Isle of Axholme. R.D.C. J. R. Taylor. Civ. Eng. (Br.) **33**: 225 (Jun. '38). The Haxley Tower, with capacity of 200,000 gal. (Imp.) is 95′ high, with max. water depth of 15′. Tower at Crowle has capacity of 100,000 gal. (Imp.) and is 35′ high. Both tanks circular. Haxley tank supported on 8-leg tower with three levels of circumferential and radial beams braced to central, concrete access shaft. Details of structural design given in the article under various conditions of loading, including tensile and compressive stresses, with moment and deflection diagrams. Principal advantage of the access shaft, as compared with equivalent strength in columns, is that it affords sure protection of pipes against freezing. On completion a test of the tank showed no leakage in six days.—*H. E. Babbitt.*

Reinforced Concrete Water Towers for the Boston (Eng.) R. D. C. Anon. Wtr. and Wtr. Eng. (Br.) **40**: 254 (May '38). The comprehensive scheme for the Boston Rural District Council in Lincolnshire, England, comprises construction of 307 mi. of mains and three reinforced concrete water towers, with capacities of 100,000, 75,000, and 40,000 gal. (Imp.) respectively. The tanks

cost £2,550, £2,025, and £910 respectively. In each case the height to water level was 50′. Space below the tanks is enclosed; that below the larger tanks housing pumping stations, and that below the smallest tank being used for storage. Foundations were on Rotinoff concrete piles which are constructed by first driving and then withdrawing a steel mandrel. Tank reinforcement was circular, in hoop tension, but the walls of the tanks were 16 sided to avoid circular form work. No attempt made to disguise the functional appearance of the concrete work and except for simple fluting the appearance is the logical outcome of economical design. Roofs are reinforced concrete, low dome shaped, 6″ thick. Tank bottoms are slabs supported on 8 beams radiating from a central hollow access shaft to columns on the periphery. Concrete was 1:2:4 and 1:1½:3 with especial control of moisture. The largest one of the tanks was asphalt lined.—*H. E. Babbitt.*

Experiences With Reinforced Concrete Standpipes. CHARLES W. SHERMAN. J.N.E.W.W.A. **52:** 201 (Jun. '38). Reinforced concrete standpipes have not generally proved to be economical or satisfactory structures. Expectation of having no cost of maintenance and no inconvenience corresponding to periodic painting of steel standpipes has not been justified. Number of such structures built in period '05–'15, few since. Descriptive details given of standpipes and experiences in Mass. cities of Attleborough, Waltham, Manchester, Rockland, Brockton, Weston, Lexington, Winchester, Falmouth and Duxbury; also Topsham, Me. and Westerly, R.I. In most cases tanks have required considerable repair to be kept watertight, one tank originally costing $19,923 in '12 had cost a total of $35,625 by '24.—*Martin E. Flentje.*

Lining the Sunset Reservoir. R. B. ROTHSCHILD, JR. Civ. Eng. **8:** 670 (Oct. '38). About 26,000 cu.yd. of concrete are contained in the lining and roof of the new 93 mil. gal. Sunset Reservoir built by the San Francisco Water Department. Reservoir so located that it can supply almost any area in the city but normally it will serve about 35% of the population. Water will cover area of 10.4 acres, with max. depth 31′. Walls will be earth embankment covered with a concrete slab. Entire reservoir covered with concrete roof of pan construction supported on circular, concrete columns on about 25′ centers.—*H. E. Babbitt.*

Low Cost Water Storage. D. E. DAVIS. Eng. News-Rec. **121:** 301 (Sep. 8, '38). Circular tank reservoir recently built in Oakland, Md., is interesting example of thin wall and dome construction of air-shot mortar, or "shotcrete." Reservoir is partially buried and has diam. of 50′, water depth about 22′ and capac. 325,000 gals. Floor shot first, leaving ample keyway for wall, 6″ thick, which was built up in 7 layers (including final exterior flash coat of cement and fine sand), employing 2 layers of reinforcing steel bars and one of light wire mesh. Wire mesh also used for reinforcing roof, which was shot in rings of full thickness. Aggregate, a crushed, friable conglomerate which was practically pure silica, was mixed with cement in proportion of 3:1. Contract price $9,206.—*R. E. Thompson.*

Building Concrete Reservoirs Without Expansion Joints. PAUL D. COOK. Pub. Wks. **69**: 8: 15 (Aug. '38). Well water from 300′–600′ deep wells supplies water to Sioux City, Iowa (pop. 85,000). '36 av. demand was 8 m.g.d. with peak of 17 m.g.d. High demand with pumping capacity of 17 m.g.d. led to $585,000 improvement consisting of 2 additional 16 mil. gal. concrete storage reservoirs and 4 m.g.d. pumping capac. Reservoirs are each 220′ diam. with 20′ to 32.5′ water depth. Covered with 7″ flat slab roof overlain with 12″-18″ of earth. Floor, wall and roof all reinforced, tied together without expansion joints to act as monolith. Water aerated for removal of H_2S and Fe, has yr.-round temp. of 55°F.—*Martin E. Flentje.*

An Unusual Form of Reservoir. ANON. The Engr. (Br.) **166**: 236 (Aug. 26, '38). The reservoir at Cassis, France, is peculiar in that the floor is formed of a series of "trunconic" sections radiating from a flat circular center. The design has advantage of distributing the water pressures without requiring an expensive foundation. 26 radial trunconic arches were built extending from the outer edge of the reservoir for about 42′. The circular, central portion of the floor was built by spreading lime mortar over the earth and casting concrete over it to thickness of 4½″. The purpose of the design was to provide suitable foundation for the reservoir which rests partly on bedrock and partly on filled ground. Reservoir is 67.7 m. dia., with max. depth 5.6 m.—*H. E. Babbitt.*

FILTRATION

Measurement of Sand Expansion. H. J. KRUM AND EVERETT M. JONES. J.N.E.W.W.A. **52**: 107 (Mar. '38). In 10 m.g.d. filter plant at Allentown, Pa., considerable difference found in amt. of wash water used by different operators, one operator using 12% less water than others. Need indicated for means of control, sand expansion deemed best method. Sand expansion meter first tried consisted of graduated dial, index pointer and pulley, with cone shaped float with base angle of 25°. Float designed to rise with sand in washing. 25° angle found too shallow. Exptl. work indicated for sand, 45° angled float satisfactory, 51.4° float req'd. for coal and zeolite. Best results obtained with float having counterweight 87% of float weight. This type of sand expansion meter found accurate and stable irrespective of filtering medium, temp. and depth of sand bed.—*Martin E. Flentje.*

Fluid Flow Through Granular Beds. P. C. CARMAN. Trans. Inst. Chem. Engrs. (London) **15**: 150 ('37). Literature and theories are discussed, and applicability of various equations is considered, with data quoted from several investigators. From original expts., it is concluded that path of fluid through granular bed is $\sqrt{2}$ times depth of bed. Proof offered that flow is greater through parallel channels of unequal size than through those of equal size. Formula for calcg. porosity is developed.—*C. A.*

Cleaning Filters with Sulfur Dioxide. J. G. PATRICK. W. W. and Sew. **85**: 90 (Feb. '38). Patented process for cleaning filters of accumulated impurities, especially iron and manganese, is described. A 24-hour contact

period of 0.3% to 3.0% SO_2 is claimed to clean sand gravel, and underdrain system, improve filtering ability of bed, disintegrate mud balls, improve wash distribution, and lengthen filter runs. Actual plant-scale trials at Luke, Md., Baltimore, Md., Batavia and Valley Stream, N. Y., are discussed in detail.—*H. E. Hudson, Jr.*

Developing Small Town Supplies. HOWARD K. BELL. W. W. Eng. **91**: 968 (Jul. 20, '38). Unusual features of water plants for towns of about 1000 pop. and using min. Underwriters' capacity requirements of 250 g.p.m. include use of surge tank on filters to eliminate rate controllers, clear well and loss of head gages, pump discharge controlling filtration rate; writer's own design of underdrains with strainers, hollow glass trap and false bottom; locating water wash tank on roof of filter plant; and provisions for automatic operation. Mt. Vernon and Greensburg, Ky. plants specifically described.—*Martin E. Flentje.*

The Cincinnati Water Supply System. A. S. HIBBS. Ann. Rept. Ohio Conf. Water Purif. **17**: 113 ('37). History of supply reviewed and present plant, constructed in '07, is described. Municipal ownership since 1839. Plant consists of masonry intake structure in Ohio R., 7′ brick-lined intake tunnel through rock, 1425′ long and 60′ below river bed to low lift station, 2 primary settling reservoirs with combined capacity of 400 mil. gal., providing 72 hrs. retention (head in reservoirs is used for power generation), 3 coagulation basins with total capacity of 22 mil. gal., 28 rapid sand filters and 19-mil. gal. open clear-water reservoir. Considerable trouble experienced with latter due to infestation with bloodworms, larval stage of *Chironomus*. Iron and lime used for coagulation and when turbidity of river water is 300 p.p.m. or higher alum added at inlet of primary basins. Effective size of filter sand increased from 0.34 mm. in '07 to 0.53 mm. in '28, when all but 16″ was discarded and replaced with 12″ of 0.37-mm. sand. Plant seriously overloaded for several yrs., necessitating, on occasion, bypassing of coagulation basins. This, together with absence of mixing facilities, inability to employ wash rates higher than 22″ rise per min. and antiquated chem. feeding equipment, rendered complete rehabilitation imperative, which is now underway (see following abstract). Operation and analytical data for period '31–'35 are given.—*R. E. Thompson.*

The New Cincinnati Water Purification Plant. C. S. TIMANUS. Ann. Rept. Ohio Conf. Water Purif. **17**: 119 ('37). Reconstruction to provide for efficient purification and softening, with ultimate capacity of 200 m.g.d. Retention of original site and parts of old plant (cf. preceding abstract) enabled construction at cost of $16,500 per mil. gal. of installed capacity: total cost will be $3,250,000. Work carried out without seriously interrupting service. Plant consists of original preliminary settling basins, hydraulic jump mixing flumes, duplicate basins providing retention period of 3½ hrs. and equipped in successive sections with 4 rows of Dorr flocculators, 2 traction-type clarifiers and Transite pipe grids for recarbonation, 40 rapid sand filters (26 old filters were reconditioned and 14 new units added) and ammonia-chlorine equipment. Chemicals unloaded by air conveying equipment and fed through gravimetric dry feed machines. Laboratory facilities unusually complete. Lecture room

accommodating 50–60 persons included. Offices and laboratory completely air-conditioned. Plant unique in being electrically operated throughout, including all valves, valve position indicators and gages. Most of power used generated by water-wheel generator sets in chemical bldg.—*R. E. Thompson.*

New Works for Brisbane Water Supply. ANON. The Commonwealth Engineer **25**: 2: 68 (Sep. 1, '37). Water normally pumped from Brisbane R. at Mount Crosby about 22 mi. upstream. Water is pumped distance of about one mi., then over aerators into mixing chambers where chemical dosing is carried out when required, thence to sedimentation basins and a low level reservoir. From the reservoir water flows by gravity to the filter about ½ mi. distant. The filters consisted until recently of 10 slow sand filters, ½ acre each and normal capacity of 1.5 m.g.d. About 12 mos. ago 12 rapid sand filters, capacity 1 m.g.d. each, of the automatic multiple unit enclosed gravity type, were brought into operation constructed in one of the existing filters. Water passes through coagulation tank and mixing tank, thence through revolving screen to a conduit and filters. Each filter divided into six compartments inter-connected at the bottom. When a predetermined loss of head is reached, filter is washed automatically. First outlet from filter is closed, then a booster on the inlet starts up and the master valve connected to the six compartments begins to rotate. Water is boosted down through five compartments at about double rate and upwashes the sixth. The dirty water passes through the master valve to a wash water receiving tank. Each compartment washed for about five minutes. After chlorination and ammoniation, water passes to clear water reservoir thence to 17 mi. trunk main. Somerset Dam, 724,000 acre ft. capacity, is being built on Stanley R. for dual purpose of water supply and flood mitigation.—*P. H. E. A.*

Augusta's New Filter Plant. R. E. IRVIN. Eng. News-Rec. **120**: 583 (Apr. 21, '38). Description of 15-m.g.d. plant, for treating turbid Savannah R. water, which will replace circular steel-tub filters installed in 1898. Presedimentation basin, 125 mil. gal. capac., and clear well of old plant retained. Flash mixing, 1 min. at 1.45 ft. per sec., provided by mixing chamber of over-and-under baffle type, followed by 30-min. flocculation period in basin equipped with mechanical agitators and 4 hrs. detention in 2 coagulation basins at flow rate of 0.13′ per sec. The filters, five 3-m.g.d. units operated at 2 gals. per sq. ft. per min., will be divided by forebays, with provision for washing each half separately. Feature of plant is use of concrete flumes instead of pipes, which not only conduct water but also act as wall elements in structural design. The 5 dry feed machines, 2 chlorinators and ammoniator will be equipped for automatic proportional control.—*R. E. Thompson.*

WATER TREATMENT—GENERAL

Economics of Water Purification. ARTHUR L. SHAW AND E. SHERMAN CHASE. J.N.E.W.W.A. **52**: 131 (Jun. '38). Discussion of subject from standpoints of broad economic value of pure water and actual cost of construction and operation of necessary works to produce safe satisfactory water. *Economic Value of Pure Water.* Object of purification is to produce water that

is non-poisonous, free of disease producing bacteria and those indicative of pollution; water that is clear, colorless, odorless and tasteless, low in hardness, mineral matter, Fe and Mn and relatively non-corrosive. Applying Olean, N. Y. experience in which waterborne typhoid caused 238 cases with 21 deaths for which, up to '33, $425,000 had been paid out in claims, any municipality responsible for waterborne typhoid is potentially liable for damages equivalent to about $20,000 per death. On assumption that half of decrease in U. S. typhoid death rate from 35.8 per 100,000 pop. (1900) to 2.8 ('35) is due to water purification and on basis of Olean awards, annual national saving due to pure water is $400,000,000. With av. water consumption 100 gal. per day per capita, this saving is $30,000 per yr. for each m.g.d. pumped; this expenditure for purification justified on basis of economic saving to community involved. Sale of bottled water is often due to objectionable character of city supply, such condition may bring about annual expenditure per capita of $2.00, equivalent to $2,000 to $20,000 per yr. per m.g.d. pumpage. Believed that each p.p.m. color above 10 represents economic loss of $200 per mil. gal daily pumpage; $400 corresponding figure for turbidity in excess of 5 p.p.m. Total annual loss due to corrosive water difficult to estimate, may be as high as $36,500 per yr. per m.g.d. These losses based on those estimated to result from uncorrected impairment of water quality and not upon cost of correction. *Economic Considerations in the Design of Water Purification Plants.* U. S. public water supplies number 7,100 serving pop. of 80 million with over 7,500 m.g.d.; 35 million people supplied with filtered water, 20 million with water chlorinated only, and 25 million with untreated water. If first cost of $18,000 to $180,000 per m.g.d. of consumption and improvement in water quality is considered, long time storage is only economically justifiable in largest supplies. Generally true that only with filtration and allied treatments can surface supplies be made wholly satisfactory. Success of treatment plant depends on both design and operation. Discussion of effect of various plant units given. *Economic Considerations in the Operation of Water Purification Plants.* In all but smallest plants technically trained supt. or chief operator will more than save salary through efficiency and economy of operation. Proper dosage of chemicals, control of filter washes and plant maintenance all effect economical operation. *Data Relative to Cost of Construction and Operation of Water Purification Plants.* Tabular data given for costs of 9 slow sand filter plants, ranging from $40,000 to $165,000 per m.g.d. cap., costs adjusted to '37; costs of 10 rapid sand plants were from $14,000 to $101,000 per m.g.d. cap.; 6 softening with costs from $21,000 to $84,000 per m.g.d. cap. Costs of operation are also given, these vary considerably, with local conditions and water character playing such an important part that good comparisons cannot be made.—*Martin E. Flentje.*

Bacteriological and Chemical Control of a Public Water Supply. A. E. PALMER AND H. N. H. LANDER. Wtr. and Wtr. Eng. (Br.) **40**: 355 (Midsummer '38). Bulk of Barnet district water obtained from eight deep wells or boreholes in chalk. One at N. Mimms situated at junction of tertiary beds and chalk close to swallow holes and brook subject to pollution discharges into these swallow holes and has marked effect on well. Water from all others good

typical chalk waters, clear and bright and of excellent organic purity, only needing chlorination as safeguard against slight contamination from which apparently no chalk water can be guaranteed to be immune. N. Mimms water coagulated with alum, allowed three hours in sedimentation tank, filtered in gravity filters and chlorinated, all other well waters chlorinated only. Constant supervision maintained over chlorination apparatus to ensure sufficient chlorine, and records of taste and odor complaints kept. Raw and treated N. Mimms water analysed chemically and bacteriologically weekly, daily tests being made for coliform organisms. Treated water in reservoir examined bacteriologically weekly. Samples from selected points sent monthly to independent analyst for bacteriological examination.—*W. G. Carey.*

Removal of Fluorine from Water. A. S. Behrman and H. Gustafson. Ind. Eng. Chem. **30:** 1011 (Sep. '38). Work of Adler, Klein and Lindsay on removal of fluorine from water with "Defluorite" (mixture of tricalcium phosphate and hydroxyapatite) was continued with cooperation of previous authors. When NaOH is used for regeneration, acid must follow to neutralize strongly held NaOH. Using HCl, 2.5 to 3% of the tricalcium phosphate mixture (TCP) is lost in each regeneration. Water contg. 5 or 10 p.p.m. of F was passed through 5.9 cm. diam. x 25.4 cm. column of 20 to 40 mesh TCP in glass tube at 1 gal. per sq. ft. per min. until effluent showed more than 1 p.p.m. of F. Regeneration accomplished with 1 liter of NaOH soln. (12 grams NaOH per liter of soln.) 1 liter of wash water, 1 liter of HCl soln. (6 grams HCl per liter of soln.) and wash water for 10 min. The 2% volume loss of TCP was made up by adding fresh material every 5th run, but TCP became almost completely exhausted in 25 to 35 cycles, making overall loss 6% per cycle. Examination of exhausted material showed increase in density from 35 to 68 lbs. per cu. ft., decrease in porosity from 72 to 45%, and appreciable increase in particle size. These difficulties eliminated when neutralization is accomplished with carbon dioxide (from commercial liquid or solid product or from combustion of any carbonaceous fuel) applied as aqueous soln. or bubbled through the bed. After 130 cycles, original volume of TCP was undiminished and fluorine removal capacity of bed and its general condition remained unaffected. No apparent change occurred in density, porosity or particle size of the TCP granules, nor in backwash rate required to loosen bed. Use of CO_2 eliminates TCP losses, and makes possible use of ordinary materials of construction instead of corrosion resistant materials needed for HCl. In 130th run, TCP sample removed, per cu. ft., 10 p.p.m. of F from over 500 gal. of water before F content of effluent increased to 0.6 p.p.m. Phosphate in effluent was never over 0.3 p.p.m. Application is being made for patent to cover use of CO_2 in TCP regeneration.—*Selma Gottlieb.*

Dusting Reservoirs with Chemicals. Anon. Eng. News-Rec. **121:** 300 (Sep. 8, '38). Successful use of blower device for scattering $CuSO_4$ in dry form for control of algae in reservoirs at Los Angeles has led to application of scheme for other chemicals, including alum, calcium hypochlorite, ammonium sulfate and activated carbon. Greater economy and effectiveness have been secured than by any method previously employed. Scattering device consists

of hopper with orifice in bottom in which 4-armed revolving scraper maintains chemical in feeding condition; blower into which chemical is sucked and then discharged through nozzle which can be rotated in half circle; and direct-connected 4-hp. gasoline motor. The 3 units are mounted on skid which can be easily transported for mounting on back of boat in any reservoir requiring treatment. Alum was distributed in 40-mil. gal. reservoir affected by flood water to obtain dosage of 2 g.p.g.: turbidity was reduced to 10 p.p.m. Application of 5½ tons of calcium hypochlorite to destroy algal growths was effected in 6 hrs.: previously, application of equivalent dosage with standard chlorinators mounted on barges required 2 weeks. Ammonium sulfate mixed with calcium hypochlorite to form chloramine has also been applied.—*R. E Thompson.*

Modern Drinking Water Treatment with Magno Filters. K. SCHILLING. Vom Wasser. **12**: 41 ('37). Primary cause of iron corrosion by water is ionisation; importance of its prevention by bringing pH value of acid waters to 7.7–8.0 is pointed out; secondary cause of corrosion may be oxidation to ferric ions, but with treatment to produce high pH passivity is produced and further solution of iron prevented. Concentration of hydrogen ions in water depends mainly on free CO_2 and its salts, in waters under 2 degrees (Ger.) carbonate hardness no protective layers are formed on iron pipes. De-acidification by aeration removes only part of free CO_2, mechanism of complete removal with calcium hydroxide and with marble is discussed. Tillmans has shown that reaction time for free CO_2 removal is directly proportional to size of marble particles when between 0.5-4.0 mm. Magno material is made by calcining broken and cleaned dolomite in rotary tube furnace 20 m. long, accurate operating conditions being maintained whereby the magnesium carbonate is completely converted to magnesium oxide while calcium carbonate remains unaltered. Particle size also important with Magno material and it is obtainable in four grades varying from 0.5–50 mm.; solubility is no more than 10 mg. per liter, and it removes free acidity 5–10 times as quickly as marble of same particle size. Marble process is of limited applicability being available only for waters with CO_2 content less than 60 mg. per liter, but reaction velocity with Magno material is scarcely affected by dissolved bicarbonate, each gram of free CO_2 requires 1.3 grams of Magno for its removal. Magno applied recently to hinder corrosion and scale formation in hot water systems, cost being 0.2–0.3 pfennigs per cu. meter. Iron removal is effected by Magno because boundary layers of filters contain saturated solutions of magnesium hydroxide and calcium carbonate with pH value of 9–10, which is optimum condition for iron precipitation. Manganese is similarly removed or is adsorbed on filter material. Use of Magno to improve bacterial condition of water (surface and swimming bath water particularly) is advocated, humic acid, algae and copper compounds are also removed. Details given of treatment of 8 different types of water show complete removal of iron and manganese, raising of pH to 8–9 and increase of carbonate hardness by 1–5 degrees (Ger.).—*W. G. Carey.*

Magno Material as Filter for Alkaline and Phosphatic Boiler Feed Water. R. MULLER. Vom Wasser. **12**: 86 ('37). In order to make mine water suitable

for boiler feed it was softened with lime and soda, filtered through gravel, mixed with requisite amount of trisodium phosphate and after pumping into a feed water container was held at 130–135°C. for 2–3 hrs. This alkaline and phosphatised water then passed through specially constructed Magno filter. Experimental filter was wrought iron tube 1800 mm. high and 200 mm. diam. containing granulated Magno layer 1500 mm. thick and 0.5–3.0 mm. size. In first experiments untreated Magno was used, and after filtration all phosphate (from 2.2 to 17 mg. P_2O_5 per liter) was removed but some hardness remained. In second experiment Magno was soaked and boiled for an hour in saturated sodium phosphate and after filtration traces of phosphate remained but hardness was only 0.14 degrees (Ger.). In third experiment Magno was again soaked for 24 hrs. and boiled for 4–5 hrs. in sodium phosphate, after filtration hardness was only a trace but some phosphate was present.—*W. G. Carey.*

Results of New De-acidification Plants at Frankfurt Waterworks. E. BUDENBENDER Vom Wasser. **12:** 117 ('37). Frankfurt (Germany) has three surface water pumping stations; raw water has carbonate hardness of 1.4 degrees (Ger.), at least 30 mg. per liter aggressive CO_2 and pH of 6.0. Existing marble de-acidification plant inadequate, filtration was through layers of marble 1.2 m. thick with filtration velocity of 2 m. per hr. with yearly consumption 55 tons of marble. Bucher lime de-acidification plant installed in which daily flow is 16,000 cu.m. with hourly addition of 11.5 cu.m. saturated lime water, whereby free CO_2 becomes zero, pH 8.2 and carbonate hardness 3.3 degrees (Ger.). Riwag closed lime de-acidification plant also installed, which automatically adjusts lime water addition to water flow of 16,000–24,000 cu.m. daily. Hourly addition of 12–16 cu.m. saturated lime water reduces free CO_2 from 35 mg. per liter to zero, increases carbonate hardness to 3.1 degrees (Ger.) and pH to 8.1. Automatic Magno material plant also in use handling 4000 cu.m. water per day. Magno material is 0.5–3.0 mm. Filtered water has free CO_2 reduced to 2.2 mg. per liter, carbonate hardness raised to 3.6 degrees (Ger.) from 1.6, and pH to 7.6 from 6.3. Spray aeration plant being constructed to handle water having 53 mg. per liter free CO_2, carbonate hardness of 13.3 degrees (Ger.) and pH of 7.0—*W. G. Carey.*

Lime Treatment of Well Waters at Panama City, Florida. THEODORE REED KENDALL. Am. City **53:** 10: 40 (Oct. '38). After 32 test wells had been driven, Panama City, Florida (14,000 pop. supplied) located its new well water supply area in the Bay Harbor end of the town. Here, 3–8″ gravel wall wells were driven into sand and tests showed productions of 185, 175 and 375 g.p.m. Three well pumps, each in its own well house, deliver water to an aerator where 50 lbs. of lime per 24 hrs. are added. After 2 hrs. retention in an outside settling basin, the water passes to two ½ m.g.d. filters and then to a 100,000 gal. clear well beneath the entire building. Chlorination of water takes place in clear well. Second floor of the filter building is the operating floor. Necessary gages and pumps are conveniently located. Also in the building is a meter repair and testing shop. Plant design is such as to permit extension.—*Arthur P. Miller.*

Heavy Chemical Treatment of Princeton, Indiana, Water. ANON. Am. City **53:** 1: 57 (Jan. '38). Heavily polluted with acid mine waste and very turbid, raw water from the Patoka River is used to supply this city's 800,000 gal. daily demand. Treatment plant consists of mixing basin, settling basin, three sand filters, clear water basin, two storage tanks and numerous chemical feeders. Under worst conditions, chemical dosages per mil. gal. are: soda ash 400 lbs., prechlorination 3½ lbs., post-chlorination 3 lbs., ammonia 5 lbs., activated carbon 28 lbs., lime 400 lbs., carbon dioxide 747 lbs., alum 375 lbs. "The alkalinity of the raw water varied from 8 to 28 p.p.m., the alkalinity of the finished water varied from 28 to 70, and the turbidity of the raw water from 90 to 2500 p.p.m. The pH of the raw water varied from 3.8 to 6.8, and of the finished water from 8.8 to 9.9. The carbon dioxide in the raw water varied from 4 to 32 p.p.m., and in the finished water from zero to 2 p.p.m. The total hardness in the raw water ran from 150 to 400 p.p.m., while in the finished water it was uniformly 200."—*Arthur P. Miller.*

Results of Experiments for Corrosion Control at Winder, Ga. W. J. WHALEY. W. W. Eng. **91:** 1209 (Sep. 14, '38). NH_3–Cl treatment and increase in pH through lime treatment to pH 9.0 for few months and then reduction to 8.0 have cleared up bad red water condition at Winder.—*Martin E. Flentje.*

Small Water Works Has CO_2 Trouble. RALPH W. GILBERT. Am. City **53:** 6: 56 (Jun. '38). Centreville, Mississippi, reduced the CO_2 content of its water from 52 p.p.m. to 4 p.p.m. by spraying it over coke in trays. Hydrated lime is added to bring pH to 8.4. Total cost of addition was $1000 which will soon be paid for by elimination of repairs previously needed.—*Arthur P. Miller.*

[New Filtration Plant in New England Industrial City. THEODORE REED KENDALL. Am. City **53:** 9: 53 (Sep. '38); Eng. News-Rec. **121:** 295 (Sep. 8, '38). Bristol, Conn. has new and compact filtration plant with circular steel structure to house filters and coagulating basins. Three-story brick building adjacent to filters and connected by closed passage-way houses heating, air-compressing and all pumping equipment except wash water pumps. Chemical feeders, laboratory and office on second floor. Chlorinators now on the main line to city will be moved into this building also. Following application of chemicals, the water flows through 2 Aer-O-Mix units and thence to a Super-Mix unit. Coagulating period is 4 hrs. with both basins in use and plant is operating at its 5 m.g.d. rate. The 4 filters form an annular ring between the coagulating basins and the centre, circular operating platform. Filters have perforated steel plate false bottoms with 17/32″ orifices on 10″ centers and small steel inverted V's welded over each orifice. There are 18″ of graded gravel and 24″ of sand. Filtering rate 2 gal. per sq. ft. per min. Under the central operating floor is located the pipe gallery and the rate controllers and wash water pumps. Two elevated steel tanks store wash water, and a wash water pond holds all wash water until it percolates through underlying gravel overnight. Two circular steel tanks each hold 400,000 gal. of filtered water situated close to the filter building.—*Arthur P. Miller.*

Cape Town Water Purification Plant. ANON. The Engr. (Br.) **165**: 557 (May 20, '38). Plans for new water purification plant have been based on results from a small experimental plant, with capacity of 300,000 gal. (Imp.) per day operated for four yrs. The new plant, with estimated cost of £65,000 will draw water from two reservoirs on Table Mt. 2,400′ above sea level. These reservoirs have combined capacity of 420 mil. gal. (Imp.). They supply insufficient water for the entire city, remaining portion of which will be supplied in about three years by the Steenbras works yet to be completed. Aqueduct from the reservoirs is partly open and partly in pipe line and tunnel, with occasional break-pressure tanks. The Kloof Nek reservoir, 884′ above sea level, receives water from the filter plant at end of the aqueduct. Raw water entering the plant is highly colored, acid, and corrosive. It is liable to pollution after heavy rains. In the new filter plant water will be coagulated with lime and alumina, then chlorinated, and pH will finally be raised to 9.2 with lime. Plant has designed capacity of 3 m.g.d (Imp.), with possible overload of 4 m.g.d. (Imp.). Purification will consist of: (1) addition of about 0.2 gr. (so given in original) lime per gal. (Imp.). (2) Passage through a launder at end of which 1.8 to 2.0 gr. of alum will be added as the water enters six mixing chambers equipped for mechanical agitation by variable-speed paddles, in which it remains for 20 min. (3) Two sedimentation tanks, each 10.5′ deep, with nominal retention period of 5 hr. (4) Six filters, each 20′ x 13′–2″ in plan with nominal capacity of 0.5 m.g.d. (Imp.). Conventional sand filters with air and water wash will be installed. (5) Secondary liming before entering the clear well. Clear well has capacity of 75,000 gal. (Imp.). It is divided into seven compartments through which the water flows in series. In first compartment the water is carbonated. Halfway through the basin water is chlorinated. Finally, in last compartment a third lime dose is applied. Contact period of ten min. elapses before water leaves the reservoir and enters discharge main. At present Steenbras reservoir, 35 mi. from the city, can supply over 20 m.g.d. (Imp.), (present consumption is 15 m.g.d.) but its bad odor causes complaints and its corrosiveness requires annual expenditure of £20,000 for pipe replacement. Plans are, therefore, under way for treatment of this water. Total cost for providing "white water" for Cape Town will be about £325,000.—*H. E. Babbitt.*

Modern Water Treatment under Semi-Tropical Conditions. Water Purification Plant at the Royal Air Force New Cantonment at Dhibban (Iraq). ANON. Wtr. & Wtr. Eng. (Br.) **40**: 129 ('38). Detailed description, illustrated, of water treatment plant which came into operation in '37 at Dhibban, Iraq. Water, drawn from the river Euphrates, is heavily silted (several thousand p.p.m. solids) at all seasons. Special precautions necessary to prevent risk of infection from water-borne diseases. Domestic water supply system comprises raw water pumps with capacity of 30,000 gal. per hr.; five-sectioned primary settling tank with total capacity of 6 hrs. flow at max. pumping rate; apparatus for addition of aluminium sulfate controlled by flow from primary settling tank; secondary sedimentation tank, in five independently controlled sections, each with capacity of 200,000 gals.; filtration unit comprising 8 vertical pressure filters each with capacity of 5,000 gal. per

hr. at max. rate of flow, i.e., 100 gal. per sq. ft. per hr.; and a sterilization unit using ammonia-chlorine treatment. Treated water is delivered to a pure water storage reservoir, serving the whole area of the cantonment. Descriptions and diagrams also given of an open-air swimming pool with capacity of 576,000 gal. Water in the pool can be recirculated in 8 hrs. through a plant in which it is treated with aluminium sulfate and soda, filtered, treated with ammonium sulfate, aerated and treated with chlorine. Growth of algae in pool is controlled by addition of copper sulfate to the recirculating water before chlorine treatment.—*W. P. R.*

A Survey of Water Filtration Practice in Canada. G. HUDSON STRICKLAND. Eng. Contract Record **51**: 17: 13 ('38); **51**: 18: 20 ('38). Extensive tabulated data are given and discussed regarding pressure and gravity rapid sand filtration plants in Canada, including coagulants used and dosages, mixing methods and periods, settling periods, size of filter units and characteristics of filtering materials, rates of filtration, backwashing rates and frequency, sterilization methods and taste and odor control practices. A tabulation of the characteristics of pressure filter plants in Great Britain and Ireland is given for comparison. There are 1258 water works systems in Canada: 7 employ filtration alone, 123 filtration and chlorination, 1 filtration and ultraviolet ray sterilization, 131 chlorination only, 2 softening and iron removal, 5 infiltration and 989 use the water without treatment. Approx. 25% of the population of the country is served with water that has been filtered and chlorinated and an addnl. 10% is supplied with water that has been chlorinated only. Alum is the most commonly used coagulant.—*C. A.*

Decolorisation of Ground Water Containing Humus. F. SARTORIUS. Vom Wasser. **12**: 152 ('37). Raw water after aeration is treated with water which has been in contact with iron filings or iron pyrites. This flocculates and combines with humus materials and filtration through Magno material removes the precipitate and excess iron. Data given show how different salts (sodium chloride, ammonium nitrate, calcium bicarbonate, iron bicarbonate, hydrochloric acid) assist filtration by causing precipitate flocs to swell, but electrolysis is best method of facilitating precipitation. Details are discussed of electrolytic method of treating water with iron, two iron plates serving as electrodes, this method being specially advantageous for all ionised and carbonated humus waters.—*W. G. Carey.*

Chemical Treatment of Soft Surface Water Containing Humus. J. TROEDSSON. Tekn. Samfund. Handl. p. 135 ('37); Chem. Zbl. **1**: 3812 ('38). Treatment of surface water used at a paper factory at Munkedal is described. Water has total hardness of 0.8° (German) and potassium permanganate demand of 20–40 mg. per liter. Colored humic material in the water is easily coagulated with aluminium sulfate. Chlorine added to destroy iron bacteria. After addition of aluminium sulfate to coagulate the negatively charged particles of humus (in cold weather sodium carbonate is also added) sedimentation is hastened by gentle stirring. Water is filtered through coarse sand. Manganese can be removed by absorption in a layer containing iron bacteria.

The pH value is maintained at 4.5–5.5 during this treatment and water is then passed through a marble filter to give pH of a little over 7.—*W. P. R.*

Water Pollution Research Board (England) Tenth Annual Report for 1937. H. M. Stationery Office, Kingsway, London, W. C. 2. Base exchange and acid exchange values of synthetic resins vary not only with phenol etc. base but also with conditions of preparation. For example resin from sulfited quebracho tannin is largely dependent on proportion of sodium bisulfite allowed to react with tannin before conversion into resin by formaldehyde. In view of possible use of resins for treatment of drinking water experiments are in progress to determine possibility of water contamination therewith. Possibility of utilising resins for removal of boron and fluorine from water is under investigation. Method devised for determining average concentration of lead in drinking water over periods is to pass water through meter and then through filter containing mixture of calcium carbonate and magnesia and to determine the absorbed lead.—*W. G. Carey.*

Tools for Sanitary Research. GORDON M. FAIR AND EDWARD W. MOORE. Eng. News-Rec. **121**: 297 (Sep. 8, '38). Illustrated description of sanitary engrg. lab. at Harvard Graduate School of Engrg. Facilities are included for phys., chem. and biol. examn. of water and sewage and for studies of water purification and sewage treatment. Small-scale equipment is employed exclusively, as large-scale models are too inflexible, are adapted only to successive rather than concurrent study of differences in operation, and usually demonstrate effects of multiple variations rather than individual operating factors. Objections to small-scale expts. become invalid if samples are properly prepd. and measurements are sufficiently precise. Water studies provided for include aeration or gas exchange, sedimentation, filtration through sand, zeolite softening, taste and odor removal by beds of granular activated carbon, correction of corrosiveness by contact with marble, etc.—*R. E. Thompson.*

PART 1

SUPPLEMENT TO JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION

VOL. 31, NO. 2 FEBRUARY, 1939

THE 1938 CONVENTION AND RESUMÉ OF 1938 SECTION MEETINGS

DISCARDED BY
U. S. D. A. LIB.

American Water Works Association
22 East 40th Street, New York, N. Y.

PART I

SUPPLEMENT TO
JOURNAL OF THE
AMERICAN WATER WORKS ASSOCIATION

VOL. 81, NO. 2 FEBRUARY, 1989

THE 1988 CONVENTION AND RESUME OF 1988 SECTION MEETINGS

DISCARDED BY
U.S. D.A. LIB.

American Water Works Association
6666 West Quincy Avenue, Denver, CO 80235

The 1938 Convention

THE fifty-eighth convention of the American Water Works Association was held in New Orleans, Louisiana, April 24th to 28th, 1938. The Roosevelt Hotel was the official headquarters. Registration totalled 1123, only 17 short of the record of 1140 set in 1937 at Buffalo. In view of the fact that membership density is greater in the Buffalo area than in the area adjacent to New Orleans, the large registration at New Orleans is added evidence of active interest in Association affairs.

The geographical distribution of the convention attendance based on home address was somewhat unusual, in the fact that the number from each state was comparatively uniform over a large area of the country regardless of the distance from the convention. This area included all of the Southern, Central and Atlantic states and included Texas. It appears that possibly over this area the density of population factor and the distance factor had about balanced each other. Attendance from the Southern states which were relatively close to the convention was very gratifying but was not large in proportion to their proximity to New Orleans. Attendance from the rest of the Plains states and the Rocky Mountain area was very small. Of the Pacific states, California was the only one with representative attendance. As in the past, Ontario furnished almost all the Canadian attendance. The numbers attending from Mexico and Cuba were very gratifying. Attendance from the Southeast was greatly aided by the action of the Southeastern Section in combining its usual spring meeting with the convention.

The efforts of the Host Committee, under the Honorary Chairmanship of Hon. Robert S. Maestri and under the Active Chairmanship of Mr. Alfred F. Theard, made the task of the Convention Management Committee considerably easier than it would otherwise have been. Every local detail necessary for the success of the convention was attended to with promptness and thoroughness. The Southwest Section, in whose territory the convention was held, placed second in the Hill Cup competition, due almost entirely to the new members gained by this committee's activity in the immediate area of the convention."

Monday—April 25th

The convention was officially opened at 9:30 a.m. by President Eugene F. Dugger. Tribute was paid to the members of the Association who had died during the period since the Buffalo convention. President Dugger, in speaking on "What's Ahead for the A. W. W. A.," said in part

"I wish to make grateful acknowledgment to each of the Sections which I have had the pleasure of visiting during my administration for the splendid reception and courteous treatment which it has given me. Each Section has held most successful and instructive meetings, and we are deeply grateful for the whole-hearted coöperation which you have given to the program of activities during the year.

"Your Association, due to your coöperation, has today the largest membership in its history. The program of activities which was presented to you at the Buffalo meeting was in substance ratified by the Board of Directors at their January meeting. It is hoped that the action of the Board in reference to constitutional changes will meet with your hearty approval and will be adopted at the business session.

"Permit me to express to the membership at large, the officers of the Association and the Water Works Manufacturers Association my deepest appreciation for the whole hearted support which you have given me in every instance. I trust that the achievements of the past year, though small, may at least be stepping stones to greater success for our Association in future years."

Reports of progress were made by the chairmen of several Water Works Practice sub-committees. William C. Mabee, who had taken gver the chairmanship of the Committee on "Laying Cast-Iron Pipe" only in January 1937, advised that the tentative report had been published in the JOURNAL for February, 1938; that the committee had given full consideration to the comments received since that time; and that a final report would be made to the Water Works Practice Committee during the convention. W. W. Hurlbut, chairman of the sub-committee on Specifications for Steel Pipe and Protective Coatings, reported that tentative specifications had been prepared and circulated; and the conferences would be held during the convention in order to obtain counsel from all persons interested in the specifications. Thomas F. Wiggin, chairman of the A. S. A. Committee A21 on Specifications for Cast-Iron Pipe, reported on further progress of his committee.

Carl H. Chatters, Executive Director of the Municipal Finance

Officers Association, and Hal F. Smith, chairman of the A. W. W. A. Coöperating Committee on the Manual of Water Works Accounting reported that the preparation of text was complete; that final review would be made by the Finance and Accounting Division during the convention; and that as soon thereafter as practicable, the text would be published.

The afternoon session opened with a description of the New Orleans Water System by Alfred Theard, Chief Engineer of the Sewerage and Water Board. George C. Earl, predecessor of Mr. Theard as chief engineer, discussed the paper.

John B. Winder, Superintendent of Water Works at Dallas, Texas, discussed "The Merit System of Dallas—as it applies to water works employees." It was shown that each employee of the water department is subject to periodical efficiency rating and that his compensation is adjusted as indicated by the rating.

"A Program of Public Safety in Water Works Operation" was discussed by Thos. W. Coleman of Chattanooga. It was shown that, following the development of a series of damage suits against the water utility (which in part appeared to be of the "racket" variety), a definite program of control of meter box and similar equipment units was set up. The result has been to improve water works service, increase organization morale and reduce damage claims.

A Round Table Discussion entitled "What About Meter Specifications" followed with C. A. Gallagher, F. W. E. Weisse, A. P. Kuranz and G. L. Fugate, as scheduled speakers. The interest in the discussion was lively. It has been followed by similar discussion in the meetings of various sections. In the meantime, the Water Works Practice Committee has reorganized its sub-committee on Meter Specifications with S. F. Newkirk of Elizabeth, N. J., as chairman. A coöperating committee form the New England Water Works Association has been appointed. The meter manufacturers, following a request from the A. W. W. A., have appointed a technical advisory committee to consult with the Association's committee.

A symposium on "Can Purchased Elelectric Power or Diesel Power be Made as Reliable As Steam Power for Pumping Stations" closed the session. W. V. Weir of the St. Louis County Water Company discussed "Electric Power." R. H. McDonnell of Kansas City presented an analysis of Diesel engine performance. Steam Power was supported by H. Clay Henning of St. Louis and the entire subject reviewed by W. W. Hurlbut of Los Angeles.

Tuesday—April 26th

The general sessions opened with the presentation of a motion picture by J. E. Longley of Ampere, N. J., which illustrated the construction of the Little Rock supply line from the new impounding reservoir.

L. W. Wallace, Director of Research of Crane Co., Chicago, discussed "Research—An Essential Tool."

Ralph Cooney of New York added greatly to the understanding of the public relations problem by his presentation of a paper entitled "The Water Works Executive and His Community." The paper was published in the May (1938) Journal and reprints are available.

Additional information of value to water works executives and engineers was developed in a discussion of "Water Supply and Air-Conditioning." O. C. Holleran of the U. S. Department of Commerce presented an analysis of a survey made in all U. S. cities of 20,000 or greater population. L. D. Gayton of Chicago, W. V. Weir of St. Louis, D. L. Erickson of Lincoln, and T. L. Amiss of Shreveport, participated in the discussion.

The afternoon session opened with a discussion of the Ground Water Supplies of the Lower Mississippi and Gulf Coast Region by V. T. Stringfield of the United States Geological Survey.

"Recent Trends in Legal Control of Ground Water Resources" were discussed by D. G. Thompson and A. G. Fiedler. This was a scholarly review of the development of legal precedent in control of underground water and has been awarded the John M. Goodell prize for the best paper published in the JOURNAL during 1938.

L. R. Howson of Chicago presented the "Problems of One of America's Largest Well Water Developments"—an analysis of the water supply development at Houston, Texas. An active discussion followed in which A. W. Ross of the Layne-New York Co., Thos. H. Wiggin of New York, H. T. Critchlow of the New Jersey State Water Policy Commission, J. B. Dannenbaum, Production Engineer of the Houston Water Department, and V. T. Stringfield participated.

A description of submersible motor-driven deep well pumps—"A New Development in Deep Well Pumping" was given by D. W. Conkling of Los Angeles. Jas. E. Phillips of the Los Angeles Water Department gave an illustrated informal talk on "The Maintenance of Dams."

Wednesday—April 27th

The session opened with a discussion of the report of the Committee on "Charges for Private Fire Protection" by Reeves Newsom. There then followed a series of round table discussions in which the membership interest was evident. In each case it was necessary to bring the discussion to an end before the views of all those who desired to participate had been expressed.

The topic, "The Sewer Rental Method of Sewerage Financing and Water Department Collection Experiences" was introduced by R. A. Allton of Columbus, Ohio, and discussed by W. W. Morehouse of Dayton, C. C. Wilbur of Minneapolis, Harry Hall of the Washington Suburban Sanitary District, and H. E. Blomquist of Cedar Rapids.

The question whether special summer sprinkling rates or other off peak rates are justifiable was debated with considerable fervor by R. E. McDonnell, George Rohan, J. K. Marquis, W. R. LaDue, John B. Winder, F. R. Mills, George F. Hughes, and others. It was evident that off peak rates for promotional purposes could be justified but that special summer rates for sprinkling added to the load at the normal peak period. Only when the capacity of the plant is considerably over present demands and when the consumers have an understanding that such rates are temporary can special sprinkling rates be advocated.

That "Electrolysis Troubles" on water lines still exist as a result of stray d.c. current was evidenced by the discussion of this topic by D. D. Gross and J. B. Dean.

Thursday—April 28th

The technical sessions opened with a progress report of the Committee on "Pipe Line Coefficients" by C. L. Bogert. There followed a valuable symposium on Corrosion Control.

Thos. H. Wiggin and George D. Norcom opened the discussion with a resume of studies made in correcting the corrosivity of certain water supplies under their control and a record of the effects upon line capacity. I. M. Glace presented the merits of limestone contact units as automatic reducers of corrosivity in small supplies where the hydraulic conditions permit such installation.

Corrections of aggressive conditions in Zeolite softened waters was discussed by D. E. Davis and H. M. Olson. Deaeration by use of sodium sulfite was shown by S. T. Powell to be an effective corrosion reducer.

J. W. Ackerman reported that the beneficial effects of chloramination in reducing friction losses in the long supply line at Utica, N. Y., continued.

Carl Alexander presented data to show that the use of lime and sodium silicate had been effective in correction of corrosive conditions in a textile mill supply.

S. F. Newkirk made an informal presentation of the topic "Selection of Water Service Pipe," expressing the opinion that water quality and soil conditions each have a bearing upon the desirability of various materials. R. S. Weston and W. A. Peirce also discussed the subject.

F. N. Speller and V. V. Kendall of the National Tube Co. summarized recent studies of "Soil Corrosivity and Pipe Protection methods."

L. L. Hedgepeth presented for the benefit of the managers and superintendents of water plants, a careful summary of the dangers incidental to the handling of liquid chlorine. The paper was illustrated by motion pictures.

Water supply progress in Mexico was discussed by Eduardo Molina and Domingo Alarcon. The former told of the developments at Mexico City and the latter, at Vera Cruz.

Thos. F. Wiggin described the theory of design of cast-iron pipe which was being taken into account by his committee in its preparation of the new specifications.

Starr Thayer advocated "Corrosion Prevention by Cathodic Protection." His ideas were supported by Robert Kuhn who has been responsible for the wide application of this method of protection in the New Orleans area.

The sessions on Monday afternoon and on Thursday afternoon were in charge of the Plant Management and Operation Division. Division officers for 1938–39 are:

Thomas L. Amiss, *Chairman*
A. P. Kuranz, *Vice-Chairman*
D. D. Gross, *Sect.-Treas.*
Samuel F. Newkirk, L. S. Vance } *Directors*

Finance and Accounting Division

This division had two sessions of its own and joined the main body of Association members in the Wednesday morning session.

Following the division session on Thursday, a luncheon was held. At this time, the officers for the year 1938–39 were announced as follows:

M. F. Hoffman, *Chairman*
Dale L. Maffitt, *Vice-Chairman*
William J. Schwartz, *Sect.-Treas.*
Jacob Schwartz, Hal F. Smith } *Directors*

The first session of the Division, on Tuesday morning, opened with the presentation of the completed "Manual of Water Works Accounting" by Hal. F. Smith, chairman of the Association's committee set up to develop the Manual. The text was approved by the Division and forwarded to the Committee on Water Works Practice for its approval. (This Committee transmitted the report to the Board of Directors. The Board authorized Reeves Newsom, Malcolm Pirnie and Harry E. Jordan to act for the Association in final approval of the text. This material was carefully scrutinized and approval given. The text went forward to the printers and the finished book was available for sale by October 10th.)

Louis D. Blum reported for the special committee which had been set up to study the classification of accounts proposed for adoption by the National Association of Railroad and Utilities Commissioners.

W. W. Morehouse of the N. A. R. U. C. discussed the proposed classification. Carter H. Lamb discussed "The Continuing Property Record and its Uses"; and the "Preparation and Uses of a List of Retirement Units" was discussed by William Schwartz.

These papers relate to another proposal of the N. A. R. U. C. namely, that all water works properties carry a continuing record of installed material and that a standard list of retirement units be set up. A. W. W. A. contact with N. A. R. U. C. activities is being maintained by the special committee under L. D. Blum's chairmanship.

The Thursday morning session opened with a discussion of "Metering as an aid to Water Works Administration" by M. F. Hoffman.

"Up-to-date Methods of Meter Testing" were described by John L. and Richard V. Ford and discussed by C. M. Roos.

"Business Procedure in the Water Sales Division" was described by Thad Erwin and discussed by Henry E. Nunn. The value of a well managed commercial department in "Safeguarding Water Revenue" was emphasized by H. L. Meites.

Joint Boiler Feed Water Research Committee

This inter-association group, organized in 1925 under the leadership of S. T. Powell, held one session during the New Orleans convention. "Inter-crystalline cracking—An explanation of its occurrence and prevention" was discussed by W. C. Schroeder, A. A. Berk and C. H. Fellows. Inasmuch as this paper brought to the attention of the group the conclusions drawn from research in the problem of "embrittlement," an active discussion followed.

"The Water Supply and Treatment Problems of the Freeport Sulfur Company" was discussed by Homer S. Burns and H. A. Smith.

"Silica Removal with Ferric Sulfate-Hydrous Ferric Oxide"—a paper presenting the results of research at Louisiana State University, was discussed by Dr. M. C. Schwartz.

All of the papers presented at this session had been made available in pre-print form and the discussion was correspondingly increased in value.

The Committee of Railway Water Treatment Chemists held a special conference on April 25th.

Water Purification Division

The Water Purification Division held three sessions and joined with the general membership in the Thursday morning conference on corrosion control. The Division also held a luncheon on Wednesday. Officers elected for 1938–9 were:

Charles Gilman Hyde, *Chairman*
Charles H. Spaulding, *Vice-Chairman*
Charles R. Cox, *Sect.-Treas.*
William M. Wallace, *Past Chairman*
M. C. Smith, *Member, Executive Committee*
Paul Weir, *Member, Executive Committee*

The first session of the Division was held on Monday afternoon with chairman Wallace presiding. M. M. Braidech reported for the committee on "Specifications and Tests for Powdered Activated Carbons." The report was discussed by L. C. Billings, W. A. Helbig, A. M. Buswell, J. R. Baylis, Edward W. Hopkins and others.

The report was accepted and ordered transmitted to the Water Works Practice Committee. (The report was accepted as a record of the Committee's best judgment relating to current conditions and printed in the August (1938) JOURNAL.)

The committee on "Chloramination" made a progress report. Chairman Geo. D. Norcom, of the committee on Coördination of Methods of Water Treatment and Laboratory Control, made a report of information which had been received from the various state health departments on the subject of obscure intestinal outbreaks. No new and definite data have as yet been developed by the committee. C. R. Cox, N. J. Howard, N. M. DeJarnette, Marsden Smith, J. J. Hinman, and W. M. Wallace took part in the discussion.

The second session of the Division opened with an abstracted presentation of a report on "Water-borne Outbreaks in the United States and Canada."

This report, prepared by A. E. Gorman and Abel Wolman, condenses data on typhoid, gastro-ententis, and other water-borne outbreaks from 1920 through 1936. The report appears in the February 1939 JOURNAL.

"The New Water Softening Plant for Minneapolis" was described by J. A. Jensen and discussed by Chas. Spaulding and Malcolm Pirnie.

The "Application of Carbonaceous Zeolites to Water Softening" was discussed by S. B. Applebaum and commented upon by A. S. Behrman.

"Fundamentals in the Training of Sanitary Engineers for the Water Works and Sewerage Fields" was the subject of an appeal by Prof. H. E. Babbitt for wider use of engineering graduates. An active discussion followed with C. G. Hyde, W. M. Wallace, E. S. Hopkins, C. R. Cox and others pointing out on the one hand that city officials often fail to appreciate the value of trained personnel and that civil service rules of residence frequently interfere with the selection of the most competent persons. On the other hand, it was also the opinion of some that the training given did not fit graduates so adequately as faculty members appeared to assume it to do.

The final session of the Division permitted the presentation of four very adequate papers, each of which has since appeared in the JOURNAL. The papers and their authors were: "Operation of the Chickasaw Filter Plant," by J. E. Jagger and A. C. Decker; "The Use of Clay in Coagulation and Taste and Odor Control," by Paul Weir; "Enhancing Efficiency and Economy in Activated Carbon Application," by Marsden Smith; and "A Unique Iron Removal Plant," by Peter Ley. The discussion following each paper was limited only by the time available.

The attention given by members to papers presented during the New Orleans Convention was materially improved by the comfort of the University Room in which at least two sessions were held each day except Wednesday.

This room was provided with cooled and mechanically circulated air and with an unusually efficient amplifying system. Never before have comfort and good acoustics so clearly demonstrated their value to A. W. W. A. conventions.

Entertainment, Exhibits, etc.

The convention city itself, New Orleans, unquestionably was a factor in attracting attendance at this convention. As a city it appears to hold popular interest which is above the average.

The splendid work of Mr. Clinton Inglee as Chairman of the Entertainment Sub-Committee was responsible for holding the convention delegates together in participation in our own entertainment activities despite the counter attractions of the City of New Orleans. This, and the efforts of the Sub-Committee on Ladies Entertainment under the Chairmanship of Mr. E. F. Dugger, contributed in a large proportion to the success of the work of the committee as a whole.

A particular feature of the entertainment program was the omission of the President's Sunday afternoon tea, which first became a part of convention activities at Cincinnati in 1935. As an informal substitute there was a gathering in the University Room of the Roosevelt at 8:30 on Sunday evening at which Mr. J. J. A. Fortier, President of the Louisiana State Museum, gave a talk on "Old New Orleans" and its attractions to visitors. More than one hundred persons attended and the event served as a profitable diversion at a time when many (especially wives of directors) have found themselves at a loss for occupation. The repetition of this type of quiet and informal entertainment may be worth while.

Another notable change in the entertainment program was the different nature of the All-Division Dinner on Tuesday evening. The professional entertainment which was introduced was excellent, but it did not arouse the enthusiasm which the previous home-talent has created.

The Golf Tournament at this convention was held on Monday instead of Wednesday as had been the habit in previous years. More than eighty men played and the tournament was successful. It does not appear advisable, however, to continue to hold the tourna-

ment so early in the convention week. Since any day during the regular technical sessions is bound to take the golf players away from the meetings, a concession should be made to their convenience by holding the tournament on Wednesday.

The Publicity Sub-Committee under the Chairmanship of Mr. Charles H. Eastwood, ably assisted by a nation-wide committee, was instrumental in bringing the convention activities before the membership and the public prior to and during the convention.

The Coöperating Committee of the Water Works Manufacturers Association on Exhibits, under the Chairmanship of Mr. Charles H. Becker, is to be congratulated on the smoothness with which this phase of the convention was handled and upon the high quality of the exhibits.

The success of the special transportation arrangements under the Coöperating Committee of the W. W. M. A. on Transportation, with Mr. John S. Warde as chairman, was unqualified. Uniting of the parties from different areas at Birmingham resulted in an unprecedented number, 206, on the special train into New Orleans on Sunday. The arrangements for a pleasant and profitable day en route on Sunday were most successful. Special transportation on the return from New Orleans was also very popular, there being 61 persons on the special train leaving New Orleans, and 52 persons on the boat to New York. There was demand for more space on the boat than was available.

The Convention Management Committee cannot let this opportunity pass without formally recognizing and expressing deep appreciation of the action of the Birmingham Chamber of Commerce in enlisting the active support of the various pipe companies and in tendering the Saturday night dinner to the members en route to New Orleans; for arrangements covering transportation to and from the various activities and for the entertainment provided for the ladies; to the several pipe companies for their courtesy in operating their plants on Saturday—a day when they would not normally have been in operation; to A. Clinton Decker, Chairman of the Birmingham Entertainment Committee, for his invaluable assistance in arranging all the details of the day in Birmingham; and particularly for the arrangement covering the visit to and inspection of the Birmingham industrial water supply plant; for the barbeque luncheon served at the site of the impounding dam; and to all members of Mr. Decker's committee.

The courtesy of the Freeport Sulphur Company in providing facilities for the visit to their workings and the invaluable assistance rendered by members of this organization in conjunction with the activities of the Association in New Orleans is worthy of special mention.

It is desired to make special mention of the excellent service rendered to the convention by the Hotel Roosevelt and by the Convention and Visitors Bureau of the New Orleans Chamber of Commerce. They could not have done more to contribute to the smoothness and ease with which the convention was conducted.

President's Address

Following the dinner on Thursday evening, President Newsom addressed the guests, saying in part:

"As a result of the progress made in recent years, the American Water Works Association stands today at a peak in its development. It has undertaken a wider scope of activities than ever before and has increased its membership beyond anything previously attained.

"To a certain extent, however, it is in the position of a business which in boom times has made great progress and has expanded its facilities in many directions. Today, when we are again faced with depressed economic conditions, the Association finds itself only well started in its effort to extend its membership to include great numbers of waterworks men who should be a part of this organization, and to impress upon the public mind the importance of the waterworks operator in his respective community. Furthermore, we have not consolidated the gains that have been made in the last few years.

"We are faced with the problem of holding the interest and enthusiasm which resulted in these many new members joining our ranks. They must be made to feel that they are really a part of the Association, that their activities and interests are of importance to the older members and that in these troublous times the Association can be of help to them.

"Some of the newer activities and efforts as yet are not bearing the fruits that they were expected to develop. Wherever possible, improvements must be made in the methods used so that they will be more effective. While a number of final reports of committees are being submitted at this convention, certain activities have been under way for quite a period of time without the results having been put in shape to be of use to the membership at large. It is essential that every effort be made to remove the obstacles to the completion of

tasks so well begun so that the benefits of the good work already done, at the sacrifice of much time and study on the part of busy men, shall not be lost but shall be made permanent.

"Activities in the formation of new sections from old ones comprising a group of states produce new problems. These new sections will need guidance in getting started in healthy fashion; and the remaining parts of the old sections must be encouraged and helped in obtaining new members to make up for those lost.

"We are again called upon to deal with the uncertainties growing out of poor business and unemployment. The proposals under consideration at Washington but add to those uncertainties. If government spending is to be speeded up, in what form will the legislation be enacted, how will it be interpreted, how administered?

"In the year ahead our big job is going to consist of holding the progress we have made as an Association, of making more effective our efforts to impress upon the people of our communities the importance of their waterworks superintendents and of devising means to continue to improve and enlarge the facilities for furnishing adequate water service in spite of all the difficulties with which we may be confronted."

Presentation of Awards

Honorary Membership in the Association was conferred upon Ralph W. Lawton of Los Angeles and Theodore A. Leisen of Omaha. The citations were:

Ralph W. Lawton, Consulting Civil Engineer, of Los Angeles, California, a member of the A. W. W. A. since 1906, a consultant on many water supply problems in India, an organizer of the California Section and still one of its loyal and active members; and

Theodore A. Leisen, General Manager of the Metropolitan Utilities District, Omaha, Nebraska, a member of the Association since 1904, its President in 1918, at various times a trustee, a director or a member of its Executive Committee, one whose service to the Association has been many sided and whose loyalty to it is unflagging.

The Diven Medal, awarded annually to the person whose service on behalf of the Association has been most outstanding, was presented to William C. Mabee of Indianapolis with the following citation:

William C. Mabee, Chief Engineer of the Indianapolis Water Company, Indianapolis, Ind. The award was made

in recognition of his diligence and constructive leadership as chairman of the technical committee on "Laying Cast-Iron Pipe." As a result of his efforts during 1937, there was completed this standard specification for pipe laying, which was accepted by the Board at its meeting and ordered printed in the Journal. Recognition of outstanding performance on the part of working committees of the Association is in line with the purposes for which the medal was established.

The Goodell Award, for the best paper published in the Journal of the Association, was presented to Vance C. Lischer of St. Louis. The citation was:

Vance C. Lischer, Engineer in charge of Production, St. Louis County Water Company, St. Louis, Mo. Mr. Lischer's excellent paper presents the solution to a water hammer problem which is typical of such problems encountered quite generally in the water systems throughout the United States and Canada and therefore is of much interest and benefit to our membership.

For the first time, the George W. Fuller award certificates were presented to men selected by various sections of the A. W. W. A. This award, established by board action in June 1937, is designed to commemorate the many services of George W. Fuller to the water works field and at the same time to permit the various sections of the Association to honor some one of their members because of the service he has been rendering in some phase of water supply activity. The certificates read as follows:

"American Water Works Association confers The George Warren Fuller Award upon of the Section for distinguished service in the water supply field and in commemoration of the sound engineering skill . . . the brilliant diplomatic talent . . . and the constructive leadership of men in this Association which characterized the life of George Warren Fuller."

It was fortunate that Col. W. T. Chevalier was able, in his eloquent and enlightening manner, to make this first group of presentations. The list of awardees and the citation for each one follows:

Canadian Section, *Albert Edward Berry*—"In recognition of his original work in the establishment and compilation of the Waterworks Information Exchange. . . ."

Florida Section, *Joseph Eugene Lyles*—"Mr. Lyles has shown outstanding qualifications in the handling of a most difficult and variable water and a system of operation that is a model for the members of our section and water purification operators in the State. . . ."

Kentucky-Tennessee Section, *Ledcreich Stuart Vance*—"Because of the outstanding service rendered in connection with flood emergency in Louisville in January, 1937."

New Jersey Section, *Charles Herbert Capen*—"For his paper on 'Water Supply of Northeastern New Jersey,' which appeared in the September, 1937, issue of the Journal and which was read at the meeting in Atlantic City last fall. . . ."

New York Section, *Edward Arnold Sterns*—"For his outstanding contribution in the improvement of the water supply system of the village (Hamburg) during the year 1937."

Southeastern Section, *Guy Haywood White*—"For his work in organizing the South Carolina Operators' Association and Short School, which has resulted in improved operation of water plants in that state."

Indiana Section, *William Curtis Mabee*—"For his constructive service to the water works field in carrying through the preparation of the tentative specification for laying cast-iron pipe."

Illinois Section, *Charles Matthias Roos*—"For his untiring efforts in the 1937 Ohio River flood, the ingenuity and resourcefulness displayed in his many years of operation of the Cairo Water Works Plant under difficult conditions, and his constructive leadership in the affairs of his community."

Montana Section, *Claude Wesley Eyer*—"Mr. Eyer meets the qualifications for this award because of his proficiency in the service rendered in the interest of the School for Water Works Operators,

sponsored by the Montana Section in coöperation with the Montana State Board of Health and the Montana State College."

The Nicholas S. Hill cup awarded annually to the section making the greater percentage gain in membership was given to the newly organized Michigan Section for a 59.6 per cent gain. The Henshaw cup, given annually to the section having the greatest percentage of its members present at its annual meeting was awarded to the Pacific Northwest Section with a record of 88.5 per cent in attendance.

Resumé of 1938 Section Meetings*

California Section

WHEN the meeting at the Mission Inn at Riverside from October 26th to 29th was over, the California Section had registered 1008 in attendance and the membership total was the largest of all the A. W. W. A. Sections. Since its organization in 1920, this Section has shown a healthy and aggressive spirit.

The Section's Water Purification Division held a dinner on Wednesday evening. The annual business meeting and informal dinner was held on Thursday evening. Three Past Presidents of the Association were present—Pracy, Hurlbut and Jordan. The George W. Fuller Award was given to G. E. Arnold of San Francisco. Resolutions were adopted opposing retroactive federal taxation of incomes of water works men.

Friday evening, the annual dinner dance was held. On Saturday morning, the delegates visited the San Jacinto tunnel of the Metropolitan aqueduct. Exhibits and meetings were held in the municipal auditorium. San Francisco was chosen as the 1939 convention city.

Scheduled Papers

Recreational Use and Drainage Area Sanitation.....Frank M. Stead
Discussion.....C. G. Gillespie and Fred D. Pyle
Reclamation of Lime and Its Re-Use in Water Softening....W. W. Aultman
Discussion.....Earl M. Kelly and Charles P. Hoover
Consumer Complaints on Quality of Water.....Gerald E. Arnold
Discussion.....J. D. DeCosta
Riverside Water Works—General Description and Problems..R. L. Boulden
New Developments in Meter and Service Installations.....George C. Sopp
Exploitation of the Uses of Water.....Max M. Socha
Automatic Water Level Recorder.....Walter M. Brown
Recent Developments in Water Bacteriology.....Ray F. Goudey
Discussion.....Charles W. Arthur
The Ammonia and Chlorine Treatment of Water at Pasadena, Calif.
C. W. Sopp

---

* At the close of this report is a tabulated list of the officers of all Sections at the close of 1938. These officers were elected at the meeting of the Section held during 1938 and reference to such election is omitted from the account of the various meetings.

Symposium, Treatment by Coagulation and Sedimentation Without Filtration.....George H. Bragg, H. B. Foster, Jr., and W. E. Wentworth
Design and Construction of Distribution Lines for the Colorado River Aqueduct.....Julian Hinds
Our Southwestern International Water Problems.....J. B. Lippincott

Canadian Section

The eighteenth annual meeting was held at Windsor on March 23rd to 25th—the third time that this city had been host to the Section. The registration reached an all time record of 415. The Canadian Water Works Manufacturers Association operated the usual exhibit of equipment. Entertainment features included an inspection of the Windsor filtration plant. At the luncheon the members were welcomed by Col. E. S. Wigle, Mayor of Windsor. At the banquet the announcement of the designation of Dr. A. E. Berry, Secretary of the Section, as the first awardee of the George W. Fuller certificate was made. The selection of Dr. Berry was based upon the recognition of the great value to members of the Canadian Section of the "Waterworks Information Exchange." This collection of information concerning water works procedures is by far the most useful activity of any Section of the Association and should be emulated by other Sections. A life membership in the Section was presented to C. D. Brown of Walkerville, Ont. (Mr. Brown died late in 1938). The retiring chairman, E. V. Buchanan, was presented with a handsome cane as a token of regard from the Section. The Water Works Equipment Association presented the Section a gavel for the use of the successive chairmen. The wood in the gavel came from a tree root removed from the old Toronto water intake in 1910 by W. H. Randall, a former member of the Section.

Scheduled Papers

Water Works Pumping Stations for Small Municipalities.
Pumps.....R. Harrison
Motive Power.....L. G. McNiece
Buildings.....S. G. Johre
The Values of Appearance and Public Recreation in the Development of Water Works Properties.....Gordon Culham
The Action of Valves in Pipe Lines.....Professor R. W. Angus
The Use of Concrete Pressure Pipe in the Montreal Distribution System
C. J. DesBaillets
Comfort Air-Conditioning—Water vs. Refrigeration.....H. Kerr
Water Works Distribution Systems.....William Storrie
Round Table Conference, Water Rates, Insurance.

The Water Supply of Greater Winnipeg.....W. M. Scott
Metropolitan Prospects for Ontario.....W. B. Redfern
Progress Report on the Accounting Manual for Water Works...Hal F. Smith
Water Filtration Practices
Canadian Practice.....G. H. Strickland
United States Practice.....W. M. Wallace
The Treatment of Subsurface Water Supplies for the Removal of Iron
R. S. Charles, Jr.

Central States Section

At Wheeling's Hotel Windsor on August 19th, the Central States Section metamorphosed into the three new Sections,—Ohio, West Virginia and Western Pennsylvania. Already the Michigan Section had developed into a fine, lusty group since its establishment in 1937. As a result of the loyal coöperation of the members in the four states, the A. W. W. A. will have, through the four groups, fuller opportunity to serve its members and its members will be in a better position to realize the values of organization.

The committee recommended that Chairman E. C. Trax, of McKeesport, be awarded the Fuller Memorial certificate for his leadership in his community and his services to the Section.

Officers were elected for the Western Pennsylvania and Ohio Sections.

Scheduled Papers

The Ohio River and Its Relation to Industry
R. B. Smith, R. G. Call, Paul Simmons, John W. Handlan
Anticipated Changes of Quality of Water in Streams by Virtue of Flood Control Dams Now Contemplated.....D. D. Rait
Beaver River Sanitation with Low Flow Augmentation.....C. H. Young
PWA Water Projects.....E. S. Tisdale
Discussion.....F. H. Waring
Removal of Manganese and Iron Deposits on Sand Filters in the Presence or Absence of Carbonates.....R. B. Adams
Cleaning Filter Sand with Sulphur Dioxide.....J. G. Patrick
Discussion.....H. G. Turner and Max U. Priester
Silicate of Soda to Improve Coagulation.....W. M. Baumgartner
Discussion.....A. R. Todd and W. L. Lawrence
Demonstration of Cleaning Filter Sand with Sulphur Dioxide....A. R. Todd
Langelier Corrosion Index (Explanation).....Prof. W. W. Hodge
Savings and Benefit with Municipal Water Softening Operations
H. M. Olson
Discussion.....A. J. Dotterwich
Suggest Special Water Rates.....W. R. LaDue

Application of Cone Valves in Water and Sewage Field..David D. Goldberg
Specifications on Carbons.....M. M. Braidech

Florida Section

Daytona Beach, under the leadership of Mayor Couch and Water Department Manager F. R. Mills, acted as host city for the 12th annual meeting of the Florida Section on May 25th and 26th.

The Section's short school, annually conducted in coöperation with Dr. A. P. Black and the University staff, was held at the Daytona Beach filter plant. The 80 registrants at the Section meeting found time for a golf tournament on the first day, dancing and swimming at the Seabreeze Club on the first evening and a dinner dance at the Chateau Lido on the closing evening.

Among those present was "veteran" W. F. Wilcox, of Atlanta—45 years an A. W. W. A. member. Present also and active was J. A. Cosculluela, of Havana, whose loyal interest in Association affairs has led to the addition of quite a list of members in the Caribbean republic.

Scheduled Papers

A. W. W. A. Affairs.....E. F. Dugger
How We Are Trying to Resolve Water Supply Problems in Cuba
J. A. Cosculluela
Licensing of Water Works Operators.....G. F. Catlett
Points for Determining Qualifications of Pipe for Underground Mains
James W. Moore
What Is a Reasonable Percentage of Unaccounted for Water...W. W. Brush
Problems of Pollution of Streams and Coastal Waters.....H. W. Streeter
Applications of Chlorine to Sewage Treatment.....L. H. Enslow
Accounting Practice for Water Plant.....Francis R. Mills
Speeding Up Lime Soda Softening.....A. S. Behrman
Methods for Removing Fluorides from Water.....A. P. Black
Interpretation of Results of Bacteriological Examinations....J. H. McClane
Important Factors of Coagulation.....Burton Graham
Operating Experiences at Fort Myers.....R. M. Gibson
Operating Experiences at Daytona Beach.....Ralph F. Brennan
Mechanical Cleaning of Water Mains.....J. A. Frank

Four States Section

The Section met at the Raleigh Hotel in Washington on October 6th and 7th. James W. Armstrong, of Baltimore, was given the George W. Fuller Award for the Section. Resolutions were adopted protesting retroactive taxation of the income of water works em-

ployees. A buffet luncheon was served at noon on Thursday and the annual dinner was held on the same evening. The registration passed 100.

Scheduled Papers

Future of the Washington Water Supply.....P. O. McQueen
The Metropolitan Idea as Applied to the Development of Water Service for the Suburbs of Washington in Virginia.....A. T. Lundberg
Experiences with Various Types of Filter Bottoms for Rapid Sand Filters
Harry B. Shaw, Carl J. Lauter, Edward S. Hopkins, J. S. Gettrust
Plumbing Hazards and Their Evaluation.....A. P. Miller
Discussion.....A. R. McGonegal and Dr. Wilmer H. Schulze
Maintaining Good Physical and Bacteriological Quality of Water Throughout the Distribution System.....George E. Harrington
Discussion.....M. H. Coblentz
Diffusing Pits for Recharging Water into Underground Formations and Chemical Well Cleaning Methods.....J. Homer Sanford
Discussion.....Paul Schweitzer
Development and Use of Carbonaceous and Resinous Zeolites
Sheppard T. Powell
Watershed Run-offs.....J. D. Carpenter
Discussion.....Charles E. Ryder
Subaqueous 30-inch Water Main under Curtis Creek, Baltimore, Maryland
J. Milton Kinnear
Experiences with Cast-Iron, Steel and Concrete Pipe.....Humphrey Beckett

Illinois Section

The Illinois Section met at Decatur on April 5th and 6th. The members were welcomed by Mayor Lee. A luncheon and banquet made up the formal entertainment. An unusual feature was the presence and roll-call of past-chairmen at this thirtieth meeting of the Section. An inspection trip to the plant of the Mueller Manufacturing Co., a favored feature of the meetings at Decatur, closed the sessions.

Scheduled Papers

Meter Maintenance.....J. A. Mitchell
The World's Largest Water Well.....Leo Ranney
Properties and Determination of Methane in Well Supply..Dr. T. E. Larson
Discussion.....H. A. Spafford
Distribution System Design and Maintenance.....George Tatnall
Experiences in Sterilization of Distribution Systems.....B. A. Poole
Round Table Discussion, Microscopic Growths in Distribution Systems and Their Food Supply.....Discussion led by Dr. A. M. Buswell
Yellow Perch as Effecting Short Filter Runs, Tastes and Odors..C. Leipold
Discussion.....H. R. Frye, L. C. Domke, and W. M. Olson

Zeolites, Their Use in Water Softening and Iron Removal....W. H. Mitchell
Discussion.....C. W. Klassen
Experiences with Filters, Big and Little.....H. E. Hudson, Jr.

Indiana Section

The thirty-first meeting of the Indiana Section was held at the Purdue Memorial Union Building in West Lafayette on April 7th and 8th. More than 200 were present—several having been in attendance at the organization meeting in Indianapolis in 1908. President Newsom—a Purdue alumnus—was present as was also Secretary Jordan. The Section designated William C. Mabee of Indianapolis to receive the George W. Fuller Award because of his work as chairman of the Committee on Laying Cast-Iron Pipe.

Scheduled Papers

Water Company Field Representatives
Meter Reading Dept., Indianapolis Water Co.
Public Relations Problems and How They Are Met
H. A. Dill, H. G. Horstman, S. M. Van Cleave, L. G. Bradford, W. A. Oeffler
Our Membership Campaign.....P. J. Kleiser
Automatic Pumping Equipment.....S. A. Canariis
National Conservation Program—Its Relation to Public Water Supplies
Richard Lieber
Licensing of Water Works Operators in Michigan.....E. D. Rich
Licensing of Water Works Operators in West Virginia.....E. S. Tisdale
Use of Water for Air-Conditioning and Its Conservation.....R. S. Thurston
Laboratory Control of Filtration Plant Operation and Maintenance of Filtration Units.....J. C. Vaughn
Experiences in the Sterilization of Distribution Systems.....B. A. Poole
Liquid Chlorine—An Illustrated Presentation.....L. L. Hedgepeth
Efficient and Business-Like Operation of Small Water Plants.....S. P. Hull
Water Waste Surveys.....Prof. F. A. Greve
The Human Element in Meeting Emergencies.....H. W. Niemeyer
Operating and Maintenance Problems
M. H. Schwartz, R. A. Hoot, Arthur Baker, H. L. Brook, F. C. Dillman and W. J. Perrine

Kentucky-Tennessee Section

The Section met in Louisville, Ky., on March 21st to 23rd, with A. W. W. A. President Eugene Dugger in attendance. A feature of the meeting was a trip of inspection at the pumping station and filter plant a little more than a year after it had been out of service during the Ohio Valley flood. Those whose memory went back further remembered that it was also the site of the experimental

studies in water filtration in 1895 under the leadership of George W. Fuller. Announcement was made that voluntary licensing of water works operators would shortly be put into effect in Kentucky and was definitely planned for Tennessee.

Scheduled Papers

Cleaning Water Mains.....Clinton Inglee
Graphitization of Cast-Iron Pipe.....James W. Moore
Population Forecasting.....James Yunker
The Plant Ledger, What It Is and Why.....H. T. Mathews
Fire Protection.....George Tatnall
The Threshold Odor Test for Better Control of Tastes and Odors
John P. Harris and George H. Hoffman
Water Chlorination.....Harry A. Faber
Air-Conditioning and Its Water Requirements.....E. R. Ronald
Licensing Water Works Operators.....Professor F. J. Cheek

Michigan Section

The first regular meeting of the Michigan Section was held at Saginaw on September 14th to 16th. The Michigan Conference on Water Purification was in session at the same time and meetings were held in parallel or jointly. Entertainment consisted of a smoker, luncheon at the Dow Chemical Co., golf and baseball at the Midland Country Club and a banquet. Hal F. Smith of the Detroit Water Department was given the Section's George W. Fuller Award because of his active promotion of the Manual of Water Works Accounting as a coöperative enterprise. Present at the meeting and active in all sessions was Howard L. Williams, Superintendent of water works at Ludington, Michigan. Mr. Williams has been an A. W. W. A. member for forty-five years. Few are senior to him in the Association.

Scheduled Papers

Cross Connections.....Edward D. Rich
News of the Field.....R. J. Faust
Microbic Dissociation and Its Effect on Water Treatment.....I. L. Dahljelm
Typhoid Fever.....Dr. Filip Forsbeck
Meteorology.....R. J. LaMarre
Operating a Small Plant.....L. E. McQueen
The Manual of Water Works Accounting.....Hal F. Smith
Discussion.....E. L. Holloway
PWA Water Works Projects in Michigan.....G. W. McCordic
Saginaw Water Supply.....J. C. Richardson

Control of Public Water Supplies in New York State.....Charles R. Cox
Plankton.....Dr. F. E. Eggleton
Activated Carbon.....R. W. Rowley
Plastics.....D. L. Gibb
Round Table Discussion led by.....J. Anthony Keils
Distribution.....H. H. Caswell
Meters.....John K. Reed
Water Treatment.....W. M. Wallace

Minnesota Section

The twenty-eighth meeting of the Section was held at the Nicollet Hotel in Minneapolis from September 29th to October 1st. The registration was 156—the largest ever recorded. A banquet was held on Friday evening and an inspection trip was made on Saturday morning. The Section endorsed J. A. Jensen for the presidency of the A. W. W. A. It was decided to recommend no Section member to receive the Fuller Award for 1938.

Scheduled Papers

Improvements in the Water Works Field.....J. Arthur Jensen
Fire Protection Elements of Water Works Systems.....Sanford Herberg
Public Relations.....Harry E. Jordan
Research Problems for the Section
Discussion led by O. E. Brownell, J. E. Thompson and Herbert S. Grove
Activated Carbon for Removal of Tastes and Odors
Discussion led by Arthur F. Mellen, Ora C. Ayliffe, U. J. Seibert and R. W. Rowley
The Relation of Water Works to Social Security.....Frank R. Shaw
Finance and Accounting
Discussion led by John C. Flanagan, J. M. Pinkerton and Felix Seligman
The Hazards of Concrete Restoration are Now Removed...Robert Kaufman

Missouri Valley Section

Over 200 attended the Des Moines meeting of the Missouri Valley Section from October 13th to 15th. Mayor Conkling welcomed the members. John W. Pray, of Fort Dodge, was given the George W. Fuller Award for the Section. Resolutions were adopted expressing the loss to the Section through the death of Phil Carlin, of Sioux City. Retroactive income taxation was opposed. A loss in Section membership was noted. Inspection trips, golf, a special luncheon, a stag dinner, and a dinner dance made up the entertainment program. Preliminary plans were laid for the 1939 meeting—the 25th of the Section.

Scheduled Papers

The Iron Problem in the Des Moines Water Supply.....M. K. Tenny
The St. Louis County Water Plant.....W. Victor Weir
Operation of the University of Iowa Water Purification Plant
J. J. Hinman, Jr.
Reinforced Concrete Pipe Construction for the Little Rock, Arkansas, Water Supply.....R. E. McDonnell
The Water Softening Plant at Marshalltown, Iowa
H. V. Pedersen and R. H. Hoops
Automatic Operation of Water Works.....C. Maxwell Stanley
Ground Water Investigations in Nebraska.....Herbert A. Waite

Montana Section

The Section, as usual, held its meeting immediately following the Water Works School. The Section meetings were held in Bozeman at the Baxter Hotel on May 13th and 14th. The registration totalled 68.

President Reeves Newsom was present and freely participated in the activities of the Section.

The legislative committee recommended support of two measures for legislative consideration. One would create, in first and second class cities, a water board type of organization for the conduct of municipal water department affairs. The second would create an examining board, under control of the State Board of Health, whose duties would be the examination and licensing of all men in authority in water works plants. The Section authorized the committee to support such bills in the next session of the legislature.

Scheduled Papers

The Water Works Operator's Place in Montana's Health Program
W. F. Cogswell, M.D.
An Appraisal of Accomplishments under the Emergency Works Program
C. W. Fowler
The Bozeman City Water Supplies.....M. E. Henderson
Air-Conditioning, Methods and Equipment.....Eric Therkelsen
The Aeration of Georgetown Lake.....John Schofield
Minimum Requirements of Good Plumbing.....C. A. Truitt
The Design, Construction and Operation of Public Swimming Pools
Thomas Lease

New England Section

The members of the A. W. W. A. resident in the New England area held their annual business meeting on March 17th. The term of

Robert Spurr Weston as director, ended at the close of the New Orleans convention. Roger Esty, superintendent of the water works at Danvers, Mass., was elected to succeed him.

New Jersey Section

The winter meeting of the New Jersey Section was held at Rutgers University on February 15th. Announcement was made of the conferring of the George W. Fuller Award upon Charles H. Capen, Jr. for his paper on New Jersey water resources.

The spring meeting of the Section (Ridgewood, May 25th) was in the nature of an inspection trip. In the morning, the filtration plant of the Hackensack Water Company was visited; in the afternoon, the well pumping station at Ridgewood.

Preliminary plans were made for full coöperation with the A. W. W. A. in holding its 1939 convention at Atlantic City.

Prof. H. N. Lendall told of the work of the Section's research committees working on Water Works Definitions, Construction and Testing of Wells, and Corrosion Control. Reference was also made to the New Jersey Water Supply Committee set up by the Section and to recommendations made looking toward the creation of a single state commission.

The fall meeting of the Section at Asbury Park on October 21st and 22nd attracted 134 water works men. The golfers had their outing and the customary dinner and dance was held. President Newsom and Secretary Jordan spoke on Association affairs.

Scheduled Papers—New Brunswick, February 15

Treatment of Underground Waters.....Discussion led by George D. Norcom
Micro-Movies, a film showing micro-organisms; made by J. B. Hawley; presented by L. T. Purcell
Superintendent's Round Table.....Discussion led by J. A. Carr

Scheduled Papers—Ridgewood, May 25

The Water Supply of Hackensack
Water Shed Treatment.....G. R. Spalding
Pumping and Distribution.....G. T. Wieghardt
The Ridgewood Water Supply.....J. Arthur Carr

Scheduled Papers—Asbury Park, October 21

The Meeker Intake and Its Relation to Water Spreading and Water Conservation.....Roswell M. Roper
Discussion.....Stuart K. Knox
The Present Status of Water Works Licensing in New Jersey
Donald M. Ditmars and Robert S. Shaw

Specifications and Testing of Deep Well Turbine Pumps...James C. Harding
Meter Specification.....Discussion led by J. G. Carns, Jr.
The Meter Master, The G-Man of the Water Works
Discussion led by F. S. Brainard
Instructions in the Use of Hydrants....Discussion led by Roswell M. Roper
Grounding of Electrical Circuits to Water Lines
Discussion led by M. Warren Cowles
Utilization of the Delaware and Raritan Canal for a Metropolitan Water Supply.....H. T. Critchlow
Some Recent Developments in Water Treatment.....Dr. Willem Rudolfs
Some Elements of Hydraulics and Application to Water Works Engineering
H. N. Lendall

New York Section

The spring meeting was held at Jamestown on March 17th and 18th. The program dealt largely with water treatment problems and much valuable information was developed. A luncheon, a banquet and an inspection trip made up the entertainment.

On September 22nd and 23rd, the Section met at Poughkeepsie. The final registration was over 200, in spite of the fact that the New England hurricane was in full blast as the meeting opened. Mayor Spratt addressed the members at luncheon. Following the technical sessions a tour of inspection of the city's water plant was made and a clam bake supper was served at the Cornell boat house. Poughkeepsie, it will be remembered, is the city which still operates a slow sand filter plant first in service in 1872. The treatment process has been modified and extended, but the original units still do their part.

On December 29th, the midwinter meeting of the New York Section was held in the Pennsylvania Hotel. There were 200 present at the luncheon. J. C. Perlas, of the Manila, P. I. water department was presented and graciously expressed the hope that he might see all present at a later day in general Association convention in Manila. A resolution was adopted, expressing regret because of the death of Allen Cuddeback, a loyal member of the Section and a former president of the Association. A further resolution was adopted expressing appreciation for the value of work done by the W.P.A. in the water works field.

Scheduled Papers—Jamestown, March 17

Automatic Valves.....William F. End
The Water Supply of Jamestown, N. Y.....C. O. Johnson
Flood Difficulties at Silver Creek.....Frank W. Brotz
Aeration at Elba, N. Y., to Control Sulphide Odors.....R. D. Bates
Difficulties with Filter Beds and Shortage of Water.....Thomas B. Heubi

Unusual Scum Formation on a Coagulation Basin.....F. J. O'Mealia
The Benefits of Cleaning Water Mains and of Installing an Equalizing Reservoir.....William Champ
Coagulation Before Slow Sand Filtration.....Arthur Smith
The Use of Activated Carbon by the Westchester Joint Water Works No. 1, Mamaroneck, N. Y.....Fred Abbenseth, J. V. Kelly and W. A. Helbig
Cleaning Filter Sands with Sulphur Dioxide.....H. M. Cook
Discussion.....F. E. Chase
Recent Destruction of Fish Life in the Niagara River.....G. E. Symons
Developments of Rapid Sand Filtration to Increase Capacity without Adding New Filters.....Ira H. Jewell

Scheduled Papers—Poughkeepsie, September 22

History of Poughkeepsie Water Works.....Walter E. Walker
Operation of Poughkeepsie Water Works Plant.....Thomas A. Cole
Public Relations—
From the Standpoint of a Municipally Owned Plant...Howard E. Wolbert
From the Standpoint of a Privately Owned Plant,—Watering the Grass Roots.....Philip B. Niles
Private Fire Lines in New York State.....Wallace T. Miller
Water Works Schools and the Qualification of Water Treatment Plant Operators.....Charles R. Cox
The Way We Do It.....H. M. Beardsley
Discussion.....Frederic W. Kilduff
The Delaware Water Supply System of New York City
Roger W. Armstrong
What is Adequate Hydrant Distribution.....George W. Booth
Main Cleaning in New Rochelle.....Eugene T. Cranch
Should the Public Be Given Recreational Use of Reservoirs
Discussion led by Earl Devendorf
Asbestos Cement Pipe.....Discussion led by W. E. Thrasher
How to Get a Meter Reading in Inaccessible Premises
Discussion led by Thomas J. Eaton
Practice of Testing Mains before Backfilling
Discussion led by William W. Brush

Scheduled Papers—New York, December 29

Water Supply and Distribution at the New York World's Fair
Benjamin Eisner
Fire Department Experiences.....Thomas F. Dougherty
Projects Undertaken by the Works Progress Administration for the New York Department of Water, Gas and Electricity.....Patrick Quilty

North Carolina Section

The eighteenth annual meeting of the Section was held at Greensboro from October 31st to November 2nd. President Newsom was

present and spoke at the annual banquet. Additional entertainment features were a barbecue and dance on Monday evening. Inspection trips were made on Monday afternoon. George F. Moore, of Albemarle, was announced as the third-time winner—now permanent possessor—of the cup given to the person who secured the largest number of new members during the year.

Scheduled Papers

The Administration of the Water and Sewer Department of the City of Greensboro.....W. M. Lybrook
Technical Description of the Sanitary Facilities of the City of Greensboro
E. H. Moss
Determining Residual Ammonia in Solutions of Chloramine.....P. W. Frisk
Sanitary Quality of Water as Indicated by 24- and 48-hour Counts
Lynn Maddry
Studies of the Effect of Sulphur Dye Waste upon Sewage Sludge Digestion
Ralph Porges
Recent Developments in Water and Sewage Treatment in North Carolina
Warren H. Booker
The Use of Property Records in Water and Sewage Works
Prof. Harold B. Gotaas
Ten Years of Office Management.....Hugo Walker
Water and Fire Fighting.....Sherwood Brockwell
Luminous Bacteria.....Dr. I. V. D. Shunk

Ohio Section

An organization meeting of A. W. W. A. members in Ohio was held at the time of the Central States Section meeting in Wheeling. Officers were elected and by-laws adopted. At the time of the 18th Ohio Conference on Water Purification on September 27th, plans were made for the first technical session of the Section to be held in Dayton in April, 1939. It was agreed that, since the conference idea had so well demonstrated itself in Ohio, the Section meeting would be called a "Conference on Water Works Management."

Pacific Northwest Section

On May 19th to 21st, the Section held its meeting at Spokane, Wash., with 232 registered—the largest number ever in attendance at a meeting of that Section—with A. W. W. A. President Newsom and his wife present. Relaxation was afforded by a golf tournament on Friday afternoon, an inspection tour on Saturday morning over the Spokane water works properties, a trip to Grand Coulee on Saturday afternoon. A buffet supper was served on Thursday

evening and a banquet with over 300 present climaxed the social events of the meeting.

The George W. Fuller Award for the Section was conferred upon W. A. Kunigk, superintendent of the Tacoma Water Department. The certificate was presented to Mr. Kunigk by President Newsom.

Scheduled Papers

Round Table Symposium—Water Meters
- Testing.....Herbert C. Jones
- Maintenance.....George Canavan
- Settings and Housings.....Fred D. Jones
- Records.....R. R. Turnbull

Round Table Symposium—Modern Practice in Water Works
- Pipe and Valves.....J. W. Cunningham
- Services and Fittings.....R. P. Duff and N. A. Gilman
- Main Line Meters.....R. E. Koon
- Pumping Equipment.....J. B. Fisken and C. H. Williams
- Water Treatment Equipment.....W. V. Leonard and M. S. Campbell
- Miscellaneous.....W. A. Kunigk and R. F. McLean

Some Problems Involved in Public Utility Valuation.....Ernest C. Willard
- Discussion.....Harold D. Fowler

Micro-Movies of Water Organisms.....Carl A. Green and Roy M. Harris

Selling the Water Works to the Public.....G. B. Schunke
- Discussion.....Richard Beatty

Water Works Planning.....G. D. Hall
- Discussion.....W. P. Hughes

Spokane Water Supply.....Alex Lindsay

The American Water Works Association.....Reeves Newsom

Progress Report on Licensing and Short Schools for Water Works Operators
Roy M. Harris

Report of the 1938 Convention at New Orleans.....R. E. Koon

Round Table Symposium—Water Treatment
- Filtration.....Walter S. Chiene and E. A. Knittel
- Chlorine and Ammonia.....James E. Morrison and O. E. Hill
- Chlorine Only.....R. O. Vognild
- Other Treatment.....C. M. Everts, Jr. and A. H. Labsap

Round Table Discussions
- Is Grounding of Electric Circuits on Piping Systems Good Practice?
Discussion led by J. G. Eornisse
- Taste and Odor Control through the control of Micro-organisms in Storage Reservoirs.....Discussion led by Glen Campbell

Selling Water Beyond the Corporate Limits of a City
Discussion led by F. Ford Northrup

Methods of Locating Leaks and of Pipe Finding in Distribution Systems
Discussion led by J. B. Downer

Methods of Sterilizing New Mains.....Discussion led by D. W. McGhee

Rocky Mountain Section

The Townsend Hotel at Casper, Wyoming, was filled to overflowing with the A. W. W. A. members and guests in attendance at the 12th meeting of the Rocky Mountain Section. A barbecue at the top of Mount Casper, after a bus ride up the kind of road they use in the thriller movies, opened the entertainment. A luncheon and a banquet were later attractions and the Section's famous night school was in session as usual. The George W. Fuller Award was designated for Dana E. Kepner, an earlier secretary of the division and still actively associated with the Section.

Scheduled Papers

Report of 1938 National Convention.....D. D. Gross
Why Aeronautical Meteorology.....Richard W. Logan
Routing of Floods through Reservoirs and Lakes.....R. D. Goodrich
Water Supply as Affected by Air-Conditioning.....John H. McCabe
Discussion.....Ben A. Brickham
Corrosion Control.....H. C. McClintock
Discussion.....K. F. Darling
Financing and Accounts of a Water System.....George F. Hughes
Infiltration Galleries.....G. M. Donnel
Metering of Water.....Eugene M. Howell
Discussion.....Henry Krull
General Condition of Wyoming Water Supplies.....L. O. Williams, Jr.
General Operating Practice as Carried out by Northfield Land & Water Company.....Chester Truman
Practical Water Analyses Demonstrations.....J. C. King and George Turre
Electrolysis.....George Cunningham
Licensing of Water Works Men and Water Works Short Course..B. V. Howe
Sewage Plant Operating Problems.....Roy Seaman and H. A. Miller
Sewage Treatment Requirements in Wyoming.....L. O. Williams
Design Data for the Sheridan, Wyoming, Sewage Treatment Plant
F. M. Veatch
Building Small Sewage Treatment Plants with Relief Labor
L. C. Osborn and A. C. Harness
Sewer Maintenance Problems.....Charles A. Davis and S. F. Elliot

Southeastern Section

This Section coöperated fully with the Association by holding no separate meeting in the spring of 1938, when the general convention was held at New Orleans. A business session, well attended by Section members, was held at 5 p.m. on Monday, April 25th, in the University Room of the Roosevelt at New Orleans.

W. H. Weir, after many years of fine service as secretary for the

Section, requested to be relieved of his duties. A special vote of appreciation was given Mr. Weir for all his services and B. P. Rice, Chief Engineer of the Department of Health in the neighboring state of South Carolina, was selected to succeed him.

Southwest Section

Four hundred persons registered at Oklahoma City for the 27th meeting of the Southwest Section October 17th to 20th. This was the largest attendance ever recorded at a meeting of this Section. Resolutions were adopted opposing retroactive federal income taxation of water works employees and opposing extension of federal taxation of state and municipal securities unless accompanied by extension of the right of states to tax federal securities.

Mayor Frank Martin welcomed the convention. President Newsom gave those present a fine picture of Association activities. Each day of the meeting, a special luncheon was held. An informal dance and floor show, a stag party, a formal dinner dance, a golf tournament and special ladies entertainment gave those present ample recreation. The Publicity Committee had done an unusually fine job of advertising the meeting and the technical program was well planned.

Scheduled Papers

Future of the A. W. W. A. ..... Reeves Newsom
PWA Program as It Affects Cities in the Southwest ..... George M. Bull
Oklahoma City Water Development Program ..... M. B. Cunningham
Recent Improvements and Developments in Coagulation
Charles H. Spaulding
Maintenance of Water Meters ..... F. W. E. Weisse
Conditioning of Water for Power Production
S. F. Mauney, Jr. and Charles Richardson
Mobilization of City Facilities in Case of Major Disasters
Fire Chief McAlpine
Municipal and Criminal Liability ..... Judge A. L. Jeffrey
The Human Mind and Body ..... Dr. Harry W. Orr
Railroad Water Supplies ..... J. H. Davidson
Specifications for Laying Cast-Iron Pipe ..... Albert R. Davis
The What and Why of Electricity ..... Oklahoma Gas and Electric Co.
Endemic Fluorosis ..... Dr. H. T. Dean
Discussion ..... Dr. E. S. Lain, M.D.
Discussion ..... Dr. Walter J. Newton
The Removal of Fluorine ..... Jack Wyatt
Methods of Testing for Fluorine ..... Dr. Basil Hayes
Discussion ..... Dr. O. M. Smith

Virginia Section

The Virginia Section met at Lexington on August 25th and 26th. Registration approached 100, with President Newsom and Past President Dugger in attendance. Unusual interest was shown in the program, with members and guests maintaining a lively interest in the papers and discussions. Again it was demonstrated that Section meetings can be successful in the smaller communities as well as in the larger ones.

Scheduled Papers

Water Supply Lines—the Old and New at Lynchburg.....Richard Wagner
Discussion.....W. L. Hall and H. B. Rice
Leakage from Distribution Systems.....A. M. Field
Discussion.....I. G. Vass and P. A. Goodwyn
Services, Kind of Pipe, Location of Meters.....G. L. Spratley
Discussion.....A. L. Meisel and R. W. Catlin
Should Plumbing Installations Be Approved by the Water Department
Eugene F. Dugger
Discussion.....Seth Burnley and C. E. Moore
Problems of Water Quality.....H. E. Lordley
Round Table Discussion on Filtration led by:
M. C. Smith, R. W. Fitzgerald, H. A. Johnson and R. J. Leveque
Water Works Operating Kinks.....D. R. Taylor
Corrosion Problems.....R. C. Bardwell

West Virginia Section

The West Virginia Section held its organization meeting at the West Virginia University in Morgantown on October 13th to 15th. More than 100 were present. President Reeves Newsom coöperated in handling the details of getting the Section organized. This group has made definite strides forward by bringing in its full quota of Active Members as well as by promoting to the fullest the addition of Affiliates from the smaller cities of the state. Every evidence points to a successful organization in West Virginia.

Elementary Bacteriology of Drinking Water.....Gilbert L. Kelso
Demonstration of Bacteriological Tests.....H. W. Speiden
What Do the Operators Think of the Licensing Act?
Perkins B. Boynton, A. L. Rhoads, Harold Weekley and E. S. Tisdale
What Does the A. W. W. A. Mean to the Water Works Profession?
Reeves Newsom
Report on the National Convention at New Orleans.....T. L. Young
Report on the Central States meeting in Wheeling.....Paul Simmons
Report of Civil Service Committee.....J. Clyde Morris
Report of A. W. W. A. Committee.....A. R. Todd

Chlorination Service Kinks.....R. C. Clement
Experience with the Use of Silicate of Soda in Water Purification at Wheeling
A. R. Todd
Recent Developments in Water Purification as Observed on a Recent Tour of the West.....Charles P. Hoover
Parkersburg's New Water Softening Plant.....Golden Underwood
Conditioning Swimming Pool Water.....William Kirchman
The Effect of the Tygart Valley Dam on Grafton's Water Supply
Harold J. Weekley
Corrosion.....Prof. W. W. Hodge
The New System of Accounts for Water Utilities in West Virginia
C. C. MacDonald
Water and Water Conditioning.....A. J. Dotterweich
The Use of the Darcograph.....W. A. Helbig
Developments in Superchlorination of Water.....Harry A. Faber
Metering and Its Relation to Purification.....W. D. Kelly
Effect of Metering in Wheeling.....J. B. Quinlan
Typhoid Epidemic Caused by Vacuum Pulling Contamination into Water Mains.....H. K. Gidley
Maintenance of Tanks and Standpipes.....William S. Staub

Wisconsin Section

Registration at the Milwaukee Meeting on October 10th to 12th passed 200 and topped all previous records. The Fuller Memorial Award for the Section was made to L. A. Smith, Secretary of the Section since it was organized. Resolutions were passed condemning retroactive taxation of water works men's income. Inspection trips and a "Gemuethlichkeit" were the order of the opening day. A luncheon for the ladies and a dinner dance for all afforded recreation on Tuesday. The Section maintained its fine record for promptness and constancy in attendance at technical sessions.

Scheduled Papers

Air-Conditioning.....Harry Beimeister
New Classification of Accounts.....Alfred L. Adams
The Viewpoint of the Water Commission.....J. H. Plank
Filter Plant Observations.....Frank Quimby
New Regulations of the State Board of Health.....Frank R. King
Speeding up Lime Soda Water Softening.....G. A. McBride
Symposium on Water Softening Operation
James E. Towne, Frank Roob, Arthur Hanson, Mr. Davidson, Mr. Carey and Mr. Ripley
Methods of Installation of Hydrants.....Verne Somers
Recent Studies on Transite Pipe.....Prof. Lewis H. Kessler
Meter Specifications and Meter Testing.....Clem Gallagher
Testing Water Meters—Why and How.....John L. Ford
Description of New Milwaukee Water Purification Plant.....Jos. P. Schwada

Officers of the Sections

Section	*Chairman*	*Vice-Chairman*	*Secretary-Treasurer*	*Past-Chairman*	*Other Members of the Section Governing Board*[1]
California	H. Reinhardt	F. S. Porter	B. S. Grant	J. E. Phillips	J. Barker, C. Hoskinson, M. Jones, B. Livingstone, J. Longwell
Canadian	A. B. Manson	—	A. E. Berry	E. V. Buchanan	C. E. Brown, L. G. McNeice, R. J. Smith, G. H. Strickland, F. G. Browne, W. Storrie, W. T. Randall
Florida	T. M. Lowe	G. F. Catlett	J. R. Hoy	D. S. Wallace	R. G. Ridgely, G. Kingsley, K. R. Chinn, F. R. Mills, W. B. Gibson
Four States	C. J. Lauter	I. M. Glace	C. A. Hechmer	H. M. Freeburn	E. Hopkins, G. Wirtz, R. Beckett, J DeGroot
Illinois	W. D. Gerber	F. G. Gordon	C. W. Klassen	F. C. Amsbary	G. B. Prindle, H. H. Gerstein
Indiana	P. C. Laux	M. H. Schwartz	J. A. Bruhn	J. L. Ford	C. L. Link
Kentucky-Tenn.	C. M. McCord	H. Arnold	H. D. Schmidt	E. E. Jacobson	H. C. Bristol, H. N. Jernigan
Michigan	C. R. Bird	R. J. LaMarre	M. N. Gerardy	E. E. Norman	R. Faust, H. Caswell
Minnesota	J. A. Jensen	E. M. Grime	R. M. Finch	F. Seligman	A. Janzig, C. Elliott, U. Seibert
Missouri Valley	B. L. Ulrich	J. C. Detweiler	E. L. Waterman	D. L. Maffitt	J. Dean, T. Filipi, E. Hopkins, E. Mathews, C. Patchen
Montana	G. E. Atkinson	C. W. Eyer	H. B. Foote	R. N. Arnold	D. S. Thomas, Kurt Wiel
New England	S. S. Anthony	F. A. Marston	S. M. Ellsworth	W. J. Scott	H. W. Griswold, P. A. Shaw
New Jersey	J. A. Carr	E. P. Hyland	H. N. Lendall	W. R. Conard	C. Capen, H. Croft
New York	E. L. H. Meyer	F. Henshaw	R. K. Blanchard	A. D. Drake	C. R. Cox, E. K. Wilson
North Carolina	W. M. Piatt	D. S. Abell	—	J. W. Kellogg	G. Moore, A. True
Ohio	W. R. LaDue	W. C. Lawrence	T. R. Lathrop	—	C. Inman, P. Burgess, M. Hoffman
Pacif. Northwest	N. A. Gilman	T. H. Judd	F. Merryfield	M. H. McGuire	R. E. Koon, M. K. Snyder
Rocky Mountain	L. O. Williams	—	B. V. Howe	O. J. Ripple	B. Coy, J. Soderstrum, K. Darling, R. Streeter, E. Bradner, C. Riddell
Southeastern	C. P. Townsend	P. Weir	B. P. Rice	D. R. Pringle	F. G. Crow, M. G. Stewart, J. H. McLure, H. F. Wiedeman
Southwest	A. R. Davis	M. B. Cunningham	L. A. Quigley	T. L. Amiss	A. Brenneke, W. McMurry, J. Montgomery, A. Theard
Virginia	H. A. Johnson	W. G. Myers	H. W. Snidow	H. B. Rice	E. Meredith,[2] R. Leveque
Western Penna.	C. H. Young	E. A. Johnson	E. P. Johnson	E. C. Trax	J. Dunwoody, M. Mansfield, A. Martin
West Virginia	T. L. Young	W. Kirchman	J. B. Harrington	A. R. Todd	A. Rhoads, H. Speiden, G. Underwood
Wisconsin	W. C. Staeffler	A. E. Hintz	L. A. Smith	W. U. Gallaher	J. Myers

[1] The A. W. W. A. Director is normally a member of the Section's governing board.
[2] Virginia Section—Secretary is H. W. Snidow; Treasurer E. C. Meredith.

NEWS OF THE FIELD

Allan W. Cuddeback, one of the distinguished water works men of the country and a loyal member of this Association, died on December 4 at his home in New York. He was one of the real leaders among water works executives, only recently having retired as President of the Federal Water Service Company. He was for many years a member of the Association's Board of Directors and was President of the A. W. W. A. in 1927. He contributed much to the preparation of the *Manual of Water Works Practice* and was active in the reorganization of the Association's activities in the mid-twenties that brought it to its present status as a technical organization. He was a fine gentleman, a leader whose passing on creates a real void in the field.

William P. Molis of Muscatine, Iowa, died on November 27 after a lifetime of service to his city's water works plant and its people. He was 83 years old.

He had regularly attended to his duties in the department, but a heart attack caused him to put aside his work and brought about his death after four weeks illness. He had been attached to the water department of Muscatine since 1876. He became a member of the A. W. W. A. in 1882 and was made an honorary member in 1936. He had been a faithful member of the Iowa water works group and was greatly respected by his associates.

Attention, Affiliates! This issue of the Journal is one of the four each year designed to be of particular interest to you. The various papers have been assembled with the idea of giving a bird's-eye view of water works operations.

Harding tells how to buy deep well pumps. Herberg and Tatnall speak from the fire underwriter's standpoint and furnish a fine lot of information not alone concerning how to provide mains and hydrants for fire protection but how to keep things in good order.

McQueen and Lundberg set fine examples of description of plant development by the man in charge. Every water works superintendent

(*Continued on page 2*)

(*Continued from page 1*)

in a medium sized community should assign himself the task of preparing just this type of statement—not alone for his own files, but in order that he may be prepared adequately to tell the facts about his department to any citizen who wants the facts.

Niles and Wolbert picture public relations activities, one from the viewpoint of the private utility, the other as a municipal operator. Plank of Appleton, Wisconsin, an active business man who has been a member of the water commission for many years, briefly records the fine public management of that department—management that every water works man should strive to provide.

No water department can get along without accounting, so every reader should be interested in Adam's discussion of the standard classification of accounts. The distribution maintenance man will find ideas in Jensen's story of the mobile repair shop and in Cranch's paper on water main cleaning. Bliven's story of the big wind that demolished the standpipe will not help the sleep of any superintendent.

It was assumed that a little home study would be useful, so Lendall's first steps in hydraulics and Hulbert's mathematics for the purification plant operator furnish material for self improvement.

Wallace, former executive of the American Engineering Council, outlines the value of research to industry and the consumer. Strickland's review of Canadian treatment practice, Hudson's study of filter sands, and Goudey's well documented criticism of current laboratory methods give the purification plant man ample food for thought.

Seriously, an effort has been made to bring together in this issue a group of papers which would interest the Affiliate as well as the members who receive the Journal every month.

E. S. Tisdale, who for many years has been State Sanitary Engineer of West Virginia, has associated himself with the U. S. Public Health Service at Cincinnati to participate in the stream pollution and control studies.

J. B. Harrington, former assistant to Mr. Tisdale (and Secretary of the new West Virginia Section of the A. W. W. A.), is now State Sanitary Engineer.

Kaarlo W. Nasi has just notified the Association of his transfer to the Territorial Department of Health in Juneau, Alaska. He is the first member that the Association has had in Alaska in a number of years. Mr. Nasi was formerly associated with the Whitman County Health Department in the state of Washington.

(*Continued on page 4*)

Nothing takes the place of

LIGHT

Nothing takes the place of

CAST IRON PIPE

IN the olden days, when the first cast iron underground main was installed, men read by the light from a candle or from oil burning in a shallow vessel. A century later came the lamp chimney, followed by other improvements in artificial lighting, most of which are now obsolete. Yet that first cast iron main is still in service and cast iron pipe, essentially the same material as in 1664, is today the recognized standard for underground mains. Nothing has taken its place. A pipe material must meet 10 requirements for long life and economical service. Some materials meet some of these requirements but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE

The Standard Material Q *for Underground Mains*

Cape Town Water Purification Plant. ANON. The Engr. (Br.) **165**: 557 (May 20, '38). Plans for new water purification plant have been based on results from a small experimental plant, with capacity of 300,000 gal. (Imp.) per day operated for four yrs. The new plant, with estimated cost of £65,000 will draw water from two reservoirs on Table Mt. 2,400′ above sea level. These reservoirs have combined capacity of 420 mil. gal. (Imp.). They supply insufficient water for the entire city, remaining portion of which will be supplied in about three years by the Steenbras works yet to be completed. Aqueduct from the reservoirs is partly open and partly in pipe line and tunnel, with occasional break-pressure tanks. The Kloof Nek reservoir, 884′ above sea level, receives water from the filter plant at end of the aqueduct. Raw water entering the plant is highly colored, acid, and corrosive. It is liable to pollution after heavy rains. In the new filter plant water will be coagulated with lime and alumina, then chlorinated, and pH will finally be raised to 9.2 with lime. Plant has designed capacity of 3 m.g.d (Imp.), with possible overload of 4 m.g.d. (Imp.). Purification will consist of: (1) addition of about 0.2 gr. (so given in original) lime per gal. (Imp.). (2) Passage through a launder at end of which 1.8 to 2.0 gr. of alum will be added as the water enters six mixing chambers equipped for mechanical agitation by variable-speed paddles, in which it remains for 20 min. (3) Two sedimentation tanks, each 10.5′ deep, with nominal retention period of 5 hr. (4) Six filters, each 20′ x 13′–2″ in plan with nominal capacity of 0.5 m.g.d. (Imp.). Conventional sand filters with air and water wash will be installed. (5) Secondary liming before entering the clear well. Clear well has capacity of 75,000 gal. (Imp.). It is divided into seven compartments through which the water flows in series. In first compartment the water is carbonated. Halfway through the basin water is chlorinated. Finally, in last compartment a third lime dose is applied. Contact period of ten min. elapses before water leaves the reservoir and enters discharge main. At present Steenbras reservoir, 35 mi. from the city, can supply over 20 m.g.d. (Imp.), (present consumption is 15 m.g.d.) but its bad odor causes complaints and its corrosiveness requires annual expenditure of £20,000 for pipe replacement. Plans are, therefore, under way for treatment of this water. Total cost for providing "white water" for Cape Town will be about £325,000.—*H. E. Babbitt.*

Modern Water Treatment under Semi-Tropical Conditions. Water Purification Plant at the Royal Air Force New Cantonment at Dhibban (Iraq). ANON. Wtr. & Wtr. Eng. (Br.) **40**: 129 ('38). Detailed description, illustrated, of water treatment plant which came into operation in '37 at Dhibban, Iraq. Water, drawn from the river Euphrates, is heavily silted (several thousand p.p.m. solids) at all seasons. Special precautions necessary to prevent risk of infection from water-borne diseases. Domestic water supply system comprises raw water pumps with capacity of 30,000 gal. per hr.; five-sectioned primary settling tank with total capacity of 6 hrs. flow at max. pumping rate; apparatus for addition of aluminium sulfate controlled by flow from primary settling tank; secondary sedimentation tank, in five independently controlled sections, each with capacity of 200,000 gals.; filtration unit comprising 8 vertical pressure filters each with capacity of 5,000 gal. per

hr. at max. rate of flow, i.e., 100 gal. per sq. ft. per hr.; and a sterilization unit using ammonia-chlorine treatment. Treated water is delivered to a pure water storage reservoir, serving the whole area of the cantonment. Descriptions and diagrams also given of an open-air swimming pool with capacity of 576,000 gal. Water in the pool can be recirculated in 8 hrs. through a plant in which it is treated with aluminium sulfate and soda, filtered, treated with ammonium sulfate, aerated and treated with chlorine. Growth of algae in pool is controlled by addition of copper sulfate to the recirculating water before chlorine treatment.—*W. P. R.*

A Survey of Water Filtration Practice in Canada. G. HUDSON STRICKLAND. Eng. Contract Record **51**: 17: 13 ('38); **51**: 18: 20 ('38). Extensive tabulated data are given and discussed regarding pressure and gravity rapid sand filtration plants in Canada, including coagulants used and dosages, mixing methods and periods, settling periods, size of filter units and characteristics of filtering materials, rates of filtration, backwashing rates and frequency, sterilization methods and taste and odor control practices. A tabulation of the characteristics of pressure filter plants in Great Britain and Ireland is given for comparison. There are 1258 water works systems in Canada: 7 employ filtration alone, 123 filtration and chlorination, 1 filtration and ultraviolet ray sterilization, 131 chlorination only, 2 softening and iron removal, 5 infiltration and 989 use the water without treatment. Approx. 25% of the population of the country is served with water that has been filtered and chlorinated and an addnl. 10% is supplied with water that has been chlorinated only. Alum is the most commonly used coagulant.—*C. A.*

Decolorisation of Ground Water Containing Humus. F. SARTORIUS. Vom Wasser. **12**: 152 ('37). Raw water after aeration is treated with water which has been in contact with iron filings or iron pyrites. This flocculates and combines with humus materials and filtration through Magno material removes the precipitate and excess iron. Data given show how different salts (sodium chloride, ammonium nitrate, calcium bicarbonate, iron bicarbonate, hydrochloric acid) assist filtration by causing precipitate flocs to swell, but electrolysis is best method of facilitating precipitation. Details are discussed of electrolytic method of treating water with iron, two iron plates serving as electrodes, this method being specially advantageous for all ionised and carbonated humus waters.—*W. G. Carey.*

Chemical Treatment of Soft Surface Water Containing Humus. J. TROEDSSON. Tekn. Samfund. Handl. p. 135 ('37); Chem. Zbl. **1**: 3812 ('38). Treatment of surface water used at a paper factory at Munkedal is described. Water has total hardness of 0.8° (German) and potassium permanganate demand of 20–40 mg. per liter. Colored humic material in the water is easily coagulated with aluminium sulfate. Chlorine added to destroy iron bacteria. After addition of aluminium sulfate to coagulate the negatively charged particles of humus (in cold weather sodium carbonate is also added) sedimentation is hastened by gentle stirring. Water is filtered through coarse sand. Manganese can be removed by absorption in a layer containing iron bacteria.

The pH value is maintained at 4.5–5.5 during this treatment and water is then passed through a marble filter to give pH of a little over 7.—*W. P. R.*

Water Pollution Research Board (England) Tenth Annual Report for 1937. H. M. Stationery Office, Kingsway, London, W. C. 2. Base exchange and acid exchange values of synthetic resins vary not only with phenol etc. base but also with conditions of preparation. For example resin from sulfited quebracho tannin is largely dependent on proportion of sodium bisulfite allowed to react with tannin before conversion into resin by formaldehyde. In view of possible use of resins for treatment of drinking water experiments are in progress to determine possibility of water contamination therewith. Possibility of utilising resins for removal of boron and fluorine from water is under investigation. Method devised for determining average concentration of lead in drinking water over periods is to pass water through meter and then through filter containing mixture of calcium carbonate and magnesia and to determine the absorbed lead.—*W. G. Carey.*

Tools for Sanitary Research. GORDON M. FAIR AND EDWARD W. MOORE. Eng. News-Rec. **121**: 297 (Sep. 8, '38). Illustrated description of sanitary engrg. lab. at Harvard Graduate School of Engrg. Facilities are included for phys., chem. and biol. examn. of water and sewage and for studies of water purification and sewage treatment. Small-scale equipment is employed exclusively, as large-scale models are too inflexible, are adapted only to successive rather than concurrent study of differences in operation, and usually demonstrate effects of multiple variations rather than individual operating factors. Objections to small-scale expts. become invalid if samples are properly prepd. and measurements are sufficiently precise. Water studies provided for include aeration or gas exchange, sedimentation, filtration through sand, zeolite softening, taste and odor removal by beds of granular activated carbon, correction of corrosiveness by contact with marble, etc.—*R. E. Thompson.*

SUBJECT INDEX

Accidents with chlorine, 1671
Accounting; *see also* Financing
  accounts, uniform; classification of, 1605
    report of committee on, 1613
    systems of in Wisconsin, 1978
  and billing at Cold Water, Mich., 1936
  developments, 459
  in small water plants, 898
  ledger, the plant, 1627
  property; original cost of, determination, 1617
    record of, continuing, 1616, 1627
    units of; 1618
      retirement, 1623, 1627
  revenue and cash, in Chicago, Ill., 1723
  water utility, changes in, 1605
Activated carbon; *see also* Treatment
  application efficiency, 1325
  comparison of tests for, 1225
  dosage of, determination, 1182, 1320
  handling and feeding of, 607
  mechanics of adsorption by, 1299
  specifications and tests for;
    final report of committee; 1133
      discussion of, 1234
    specimens of current, 1195
  types of, 1299
  use of, at; Neenah, Wis., 600
    Oskosh, Wis., 594
    Wheeling, W. Va., 119
Adsorption; calculations, 1320
  mechanics of, by activated carbon, 1299
Aeration; *see also* Treatment
  for iron removal, under pressure, 1495
Air conditioning; and water consumption, 454, 875, 881, 896
  in Chicago, Ill., 892
  regulation of water use for, 482
Akron, Ohio, special industrial rates, 1278
Algae; control by chemicals, 437
  in distribution systems, and their food, 1651
  of Lake Winnebago, 594
  temperature effects on, 798
Alkalinity; control by zeo-karb, 966
  physiological aspects of, 252
Aluminum salts in water, 247
American Water Works Association; Canadian Section's "Information Exchange," 2051
  committee reports; accounts, uniform classification of, 1613
    activated carbon, specifications and tests for, 1133
      discussion of, 1234
    general policy, discussion of, 1596
    grounding, American research committee on, 1773
    laying cast iron pipe, tentative specifications for, 215
  constitution and by-laws; *supplement, following p. 1594, in Sept. issue*
    amendments to, 1409
  index to Journal Volume 29, 1937, *separate supplement to March, issue*
  membership list, *separate supplement to July issue*
  objectives of, in education, 1597
  secretary's report and audit, 520
American Water Works & Elec. Co., public relations policies of, 1917
Ammonia; *see also* Chloramination, Treatment
  pyridine in salts of, 260
  use of at Wheeling, W. Va., 113
  with silver, 131
Anthrafilt, *see* Coal
Appleton, Wis., water works management, 1926
Arkansas improvement financing act, 2
Arlington Co., Va., water system, 1938
Arsenic salts in water, 247, 493
Atlanta, Ga., experience with clay in coagulation, 1532
Automatic fire protection; *see also* Fire service
  relation of water works to, 580

Back-siphonage, *see* Cross-connections, Plumbing

Bacteria; *see also* Water analysis
effect of pH on, 117
typhoid, survival in nature, 124
Bacteriology, developments in at Los Angeles, 2010
Baltimore, Md., 30″ subaqueous main laying at, 1791
Bentonite; *see also* Clay, Treatment
use in water treatment, 498
Beverly Hills, Calif., corrosion studies, 90
Billing, *see* Accounting
Birmingham, Ala., industrial water supply, 56
Boiler; feed water; *see also* Softening, Treatment
carbonaceous zeolites for treatment of, 951, 963
desirable characteristics of, 487
silica removal from, 659
softening, for sulfur mining, 655
treatment of, 1631
steel, intercrystalline cracking of, 679
Bonds, revenue, 2
Boron in water, 489, 492
Bozeman, Mont., guaranteed well contract, 574

Calcium and magnesium; *see also* Hardness
determination by soap, 1032, 1040
effect on hardness by soap test, 1028
Calcium carbonate corrosion index, 85
California; *see also* Central Valley, Santa Clara Valley, and names of cities
constitutional amendment regarding water rights, 1069
Canada; *see also* Nova Scotia
filtration practice in, 2030
industrial waters in, 137
Carbon, *see* Activated Carbon
Cast iron; *see also* Pipe
pipe, experiences with at Washington, D. C., 1780
Cathodic protection; *see also* Corsion, Electrolysis
for corrison prevention, 1442, 1644
of Mokelumne aqueduct, 38
Cayuga, N. Y., filter plant, 273
Cedar Rapids, Iowa, sewer rentals, 1296
Central Valley project in California, 389
Charlottetown, P.E.I., water works, 160
Chattanooga, Tenn., meter readers' code, 863
Chemical; character of waters, 242, 495
dosage, computation, 2052
Chicago, Ill.; air conditioning in, 892
lake water diversion by, 1114
revenue and cash accounting methods, 1723
Water Pipe Extension Bureau, 1954
Chickasaw, Ala., filter plant, 1655
Chloramination, *see also* Ammonia, Chlorine, Treatment
for algae and slime control, 448
prevents tuberculation, 1385
Chlorine, *see also* Chloramination, Sterilization, Treatment
activated carbon, and, 1328
analysis of, 1673
for; iron removal, 1498
micro-organism control, 446, 1653
slime prevention, 77, 446
sterilization of; mains, 235, 1471
wells, 1130
physiological aspects of, 259
specifications and accidents, review of, 1671
temperature effects on treatment by, 807
testing for residual, 115, 458
use of, in Canada, 2043, 2050
Cicero, Ill., reducing unaccounted for water, 10
Cincinnati, Ohio, metering practices, 1718
Citrate ricinoleate agar medium, 1808
application to water and sewage, 1821
Clay; *see also* Bentonite
use of in coagulation and taste and odor control, 1528
Cleaning, main; *see also* Main, Pipe
at New Rochelle, 1964
value of, 773
Cleveland, Ohio, sewer rental ordinance, 1293
Coagulation; *see also* Treatment
Canadian practice in, 2031
odor removal by, 1327
temperature effects on, 803
weak, controls choice of filter materials, 2003
with; Bentonite clays, 498
clay, 1528
Coal; *see also* Filter
filter, managanese and iron deposits on, 1836
versus sand, as filter medium, 812, 1993

Coatings, protective, pipe; *see also* Corrosion, Pipe
chemically deposited, *see* Treatment
of metals to resist corrosion, 767, 1638
testing of in place, 41
Cold Water, Mich., water works operation, 1929
Cold weather difficulties with services and meters, 856
Colorado river, analyses of, 495
Color removal; *see also* Activated Carbon, Treatment
at Chickasaw, Ala., 1655
Bentonite clays for, 504
by activated carbon, 1299
Columbus, Ohio, sewer rentals, 1289
Commission management of water works, 1926
Concrete pipe, reinforced; for Montreal water works, 1478
experiences with at Washington, D. C., 1780
Concrete tanks at Sacramento, Calif., 402
Consumption, *see* Water consumption
Contracts, ethics of, guaranteeing well capacity, 574
Copper; salts in water, 245, 485
sulfate; *see also* Algae, Treatment
as an algicide, 444
with chloramination, 450
Copperas, use of; *see also* Treatment at Wheeling, W. Va., 114
Corrosion; *see also* Cathodic protection, Coatings, Main, Pipe, Soil
control; developments, 456
symposium and discussion of, 1342
in sulfur mining supply pipes, 653
intercrystalline, in steel, 679
Langelier index for, 85, 1375, 1802
marble test for, 737
of mains; 774
prevalence of, 1344
prevention by inhibitors, 736
protection for metals, 767, 1638
soil; cause of, 749
developments in, 1635
prevention, 614
testing, 746, 760
theories of, by water, 1353
water treatment, to prevent, 265, 1353, 1366, 1375, 1384, 1385, 1386, 1655, 1802
Cross-connections; *see also* Plumbing
example of in Nova Scotia, 158
Cuba, water systems of, 1335
Customer service and relations, 855, 872, 900, 927

Dallas, Tex., merit system for water works employees, 1540
summer sprinkling rates, 1282
Dam, earth, at Birmingham, Ala., 61
Dayton, Ohio, sewer rentals, 1291
Daytona Beach, Fla., accounting methods, 898
Denver, Colo.; electrolysis troubles, 1453
summer sprinkling rates, 1283
use of coal as filter medium, 812
Detroit, Mich., study of settling tanks, 335
Diesel power for pumping, reliability of, 1690
Dillsburg, Penna., corrosion control, 1370
Distribution reservoirs, *see* Reservoir
Distribution system; *see also* Pipe, Main, Reservoir
and fire protection, 1953
developments, 455
leakage reduction at Winchester, Va., 1787
microscopic growths in, 1651
sterilization, 235, 1471
Dry ice for cleaning wells, 1130, 1764

Earthquake, resistance against, of tanks at Sacramento, 408
East Bay Munic. Util. District; *see also* Mokelumne aqueduct
corrosion studies, 90
East Helena, Mont., water works, 557
Education of sanitary engineers, 1595
Electric power for pumping, reliability of, 1684
Electrolysis; *see also* Cathodic protection, Grounding
cause of red water, 116
surveys and mitigation, 1767
troubles, a discussion, 1451
Employees, *see* Water works employees
Ethics of contracts guaranteeing well capacity, 574
Expansion joints in concrete tanks, 407

Federal; income tax, 461
social security act, 461
water resources committee, 460
Feeders, for activated carbon, 607
Filter; *see also* Filtration, Treatment
capacity increase by sub-surface filtration, 817

drifting sand at Toronto, 2049
glass tube, value of, 1995
materials; coal vs. sand for, 812, 1993
comparison and evaluation, 1992
manganese and iron deposits on, 1836
slime removal from, with salt, 116
operation, effects of temperature on, 802
plant at; Cayuga, N. Y., 273
Chicago, experimental, 1995
Chickasaw, Ala., 1655
New Orleans, La., 1108
Palmyra, N. Y., 280
Vera Cruz, Mexico, 1125
pressure; in Canada, 2032
for iron removal, 1494, 1507
runs, length of, 1992
Filtration; *see also* Filter, Treatment
and water quality, 1992
practice in Canada, 2030
sub-surface, 817
Financing; *see also* Accounting
main extensions, 1
policies, 459
sewerage, by sewer rentals, 1285
Fire hydrant, *see* Hydrant
Fire service; private; charges for, 1665, 1668
Los Angeles, Calif., practice, 916
New York State rates and practices, 1847
relation of water works to, 580
public; and the distribution system, 1953
Cuban conditions and practice, 1339
elements involved in, 1946
hydrant distribution for, adequate, 1855
justification of charge for, 477, 480
small towns, for, 563
Fluorides in water, 257, 455, 491
Ford Motor Co. water supply, 67
Forestry at Springfield, Ill., 590
Freezing, *see* Cold weather
Fresno, Calif., tank, study for, 416

General Policy Committee, co-operation between industry and education, discussion of report on, 1596
Goldfish, effect of water on, 490
Grass roots, watering the, 1917
Grounding of electrical circuits; *see also* Electrolysis
American Research Committee on, progress report, 1773
Ground water; *see also* Well
Houston, Tex., problems, 1092
legal control of; 1049
on Long Island, 1756
Long Island; 289, 302, 319
references on, 324
methane in, properties and determination, 1828
New York City sources of, 298
recharging by diffusing wells on Long Island, 1755
replenishment in Santa Clara Valley, 326

Hardness; *see also* Calcium, Softening
Canadian waters, of, 140
considerations of, various, 485
determination of, 458, 1021
Great Lakes, of, 141
physiological aspects of, 251
soap test for, improvement of, 1021
Hood for water inspection, 121
Houston, Tex., well water problems, 1092
Hydrant; capacity marking system criticized, 1962
distribution of; adequate, 1855
and design, 1951, 1959
setting specifications, 230
Hydraulics and water works engineering, 2063
Hydrogen ion concentration, *see* pH

Income tax, *see* Federal
Indianapolis, Ind.; cold weather service in '36, 856
meter reading practices, at, 864
Industrial water supply; Birmingham, Ala., 56
Canadian, 137
characteristics, desirable, 489
Ford Motor Co., 67
Palmyra, N. Y., 284
rates for, special, 1278
Inhibitors; for corrosion prevention, 736
sodium chromate as, 744
Intake at; Cayuga, N. Y., 274
Ford Motor Co. plant, 72
Palmyra, N. Y., 282
Inventory, *see* Accounting
Iodine, in water, 258
Iron; deposits on filter sand, 1836
removal; 315
plant, a unique, 1493
pressure filters for, 1507
salts in water, 253, 485
silica removal, for, 669
Iron sulfate, *see* Copperas

Irrigation; lawn, controlling demand for, 890
rates; in Los Angeles, 925
special summer, 1265
water, characteristics affecting, 488

Jamaica Water Supply Co. iron removal plant, 1493

Kenilworth, Ill. sub-surface filter, 823

Laboratory procedure, developments in, 457
Lactose broth, modified, 979
Langelier corrosion index; 85
practical application of, 1802
Lead; for pipe jointing, 227
salts in water, 248
Leakage; *see also* Pipe testing, Waste reduction; 10
at Winchester, Va., 1787
Licensing; *see also* Schools
of operators, 78, 461
Lime, use of; *see also* Treatment
for corrosion prevention, 737
temperature effect on treatment by, 808
Wheeling, W. Va., at, 112
Lincoln, Nebr., air conditioning water use, 881
Linings, pipe, *see* Coatings, Corrosion, Pipe
Little Rock, Ark., summer sprinkling rates, 1265
Long Island ground waters; New York City sources in, 298
quality and analyses, 302, 319
recharging by diffusor wells, 1755
references, 324
resources, 289
Los Angeles, Calif.; business procedure, supply, rates of, 913
corrosion studies, 92
metering practices at, 1722
new bacteriological methods and medium at, 2010
Louisville, Ky., water use for air conditioning, 884
Lumber, use of treated for water works, 784

Main extensions; financing, 1
Arlington Co., Va., at, 1944
Los Angeles, Calif., at, 918
Main, water; *see also* Distribution, Pipe
cleaning; at New Rochelle, N. Y., 1964
value of, 773
concrete, reinforced; at Montreal, 1478
experiences at Washington, D. C., with cast iron, steel and concrete, 1780
laying; 612
specifications for, 215
sterilization of, 235, 1471
sub-aqueous, 30″, at Baltimore, Md., 1791
Manganese deposits on filter sand, 1836
Manual for water works operators (publication), 2081
Maritime water supplies, *see* Charlottetown, St. Stephen
Mathematics of water treatment, 2052
Mercury as an algicide, 446
Merit system of Dallas, Tex. applied to water works employees, 1540
Meter; as an aid to water works administration, 1716
Cincinnati, Ohio, practices at, 1718
effect on consumption of, 872, 876
freezing and maintenance of, 858
Indianapolis, Ind., reading at, 864
installation and maintenance, 515, 930
Los Angeles, Calif.; practices at, 1722
setting charges for, 916
Netherlands; experiences with, 617
specifications, 643, 647
New Orleans, La., installation in, 1112
ownership of, 1717
private fire services on, 1848
readers and public relations, 1920
readers' code, 863
records, 909
size, choice of, 619
specifications, discussion of, 981
testing; 13, 630, 930, 940
by elevated tank, 1933
rate indicator for, 943
Methane, properties and determination of in water, 1828
Metropolitan pipe joints, testing 30″, 1793
Mexico City, Mex., water works, 1116
Microscopic organisms, *see* Algae
Mineral salts in water, 242, 495
Minneapolis, Minn.; repair truck, 1974
softening plant, 1574
Minneapolis-St. Paul sewer rentals, 1293
Mississippi river, characteristics of, 1106

Mokelumne aqueduct, cathodic protection of, 38
Mold spores at Wheeling, W. Va., 118
Montreal, Canada, concrete pressure pipe in, 1478
Motors, electric; controls for, 1394
deep well, submersible, 1399
selection of, for pumps, 567, 1393
Mount Vernon, N. Y., water department's public relations, 1923
Moving the Springfield, Ill., water works, 585

National Assn. of Rwy. & Util. Comm., classification of accounts proposed by, 1605, 1613
Neenah, Wis., treatment plant, 600
New Orleans, La., water system, 1103
New Rochelle, N. Y., main cleaning at, 1964
New York City; ground water recharging on Long Island, 1755
Long Island water sources, 298
plumbing hazards in public buildings of, 1776
New York State; ground water control on Long Island, 1756
rates and practices for private fire lines, 1847
water control law of '33, 1077
Nova Scotia, Canada, water supplies, 138, 152

Oakland, Calif., *see* East Bay District, Mokelumne aqueduct
Odor; *see also* Activated carbon, Treatment
control by clay, 1528
removal by activated carbon, 1299, 1326
threshold test for, 1173
Oligodynamy, *see* Silver, Sterilization
One man town, the, 557
Oshkosh, Wis., treatment plant, 594

Paint; *see also* Coatings, Corrosion, Pipe
corrosion resisting, 770
Palmyra, N. Y., filter plant, 280
Pasadena, Calif., corrosion studies, 98
Personnel, water works, *see* Water works employees
pH; effect on bacteria, 117
saturation, of water, 1807
Phenol, colorimetric estimation of, 1162
Physiological effects of minerals in water, 242, 484, 744

Pipe; *see also* Coatings, Corrosion, Distribution, Main
cleaning, 773, 1347, 1964
concrete, reinforced, in Montreal, 1478
couplings; Gibault, 1119
Metropolitan, tests of, 1793
cutter, 1785
experiences at Washington, D. C., with cast iron, steel, concrete, 1780
flow in, 2063
friction coefficients, 774, 1346, 1964
Cuban experiences with, 1336
laying; problems, 612, 1783
specifications, 215
protection from corrosion, 757, 765, 1638
sterilization, 235, 1471
testing and leakage, 231, 615, 1488
wood, creosoted, 786
Planning, *see* Water supplies
Plumbing; codes, 466
control of, 464
hazards; evaluation of, 1702
prevention by control, 464
U. S. Pub. Hlth. Service report on, in N. Y. city, 1776
installation approval by water dept., 1775
Public; *see also* Customer, Federal
health in Cuba, 1341
relations; 458, 721, 855, 872, 1600, 1917, 1923
of municipal plants, 1923
Publications, new, reviews of, 1886, 2081
Publicity for water works; 721
at Little Rock, Ark., 1268
Pumping; automatic controls for, 1388
Cayuga, N. Y., plant, 276
comparative reliability of electric, Diesel and steam power for, 1684
deep well; specifications and testing of units for, 2071
submersible units for, 1399
discharge valves for, 1389
electric motors for, selection of, 567
for fire service in small towns, 563
Ford Motor Co. plant, 75
head, computation of, 510
Mexico City, Mex., plant, 1119
New Orleans, La., plant, 1109
statistical reports of, 507
Vera Cruz, Mex., plant, 1125
Purification, *see* Treatment

Rates, water; *see also* Air conditioning, Water consumption
at: Arlington Co., Va., 1942
Cold Water, Mich., 1935
Fresno, Calif., 418
Los Angeles, Calif., 914
New Orleans, La., 1113
Cuban practice with, 1337
establishment of, 472
for fire service, private; 1665, 1668
in New York state, 1847
sewer rental based on, 1285
special; industrial, 1278
summer sprinkling and off-peak, 1265
wholesale, at Winnipeg, 1882
Red water, *see* Corrosion, Electrolysis
Regional planning, *see* Water supplies
Report; *see also* American Water Works Association
forms for plant operation, 910
of water works statistics, 507
Research,—an essential tool, 1986
Reservoir; *see also*, Distribution, Tank
distribution, 432
elevated, and for re-pumping, 887
recreational use of, 589
roofs of treated lumber, 786
temperature effects on, 794
Resources, water, *see* Federal, Water supplies

Sacramento, Calif., concrete tanks, 402
St. Louis, Mo., consumption and pumpage, 886
electrolysis troubles, 1451
St. Stephen, N. B., water works, 164
San Francisco, Calif., corrosion studies, 102
Sanitary engineer, the training of, 1595
Sanitary engineering as a profession, 1602
San Mateo, Calif., corrosion studies, 103
Santa Clara Valley ground water replenishment, 326
Schools, short; *see also* Licensing, Water works employees
developments in, 461
effect, possible, on the industry, 1603
Sedimentation; *see also* Treatment
tanks, circular, study of, 335
Selenium salts in water, 256, 489, 492
Service connections; at Cold Water, Mich., 1934
control of size of, 467
for private fire services, 1848
leak detection in, 869
maintenance of, 856
Settling, *see* Coagulation, Sedimentation, Treatment
Sewer rental financing of sewerage, 1285
Shasta dam, 397
Shreveport, La., air conditioning water use, 883
Silica; as cause of intercrystalline steel cracking, 680
removal of for boiler feed, 659
Silver, *see also* Sterilization
as sterilizing agent, 131
salts in water, 257
Slime, *see also* Algae
control by chemicals, 437
Soap test for hardness, improvement of, 1021
Social security, *see* Federal
Soda, ash and caustic, for corrosion prevention, 738
Sodium; *see also* Silica, Soda
bicarbonate, removal by zeolite, 957
chromate, as an inhibitor, 744
salts; in boiler water, 680
in water, and potassium, 254
silicate for corrosion prevention, 738, 1386
Softening; *see also* Boiler, Hardness, Treatment, Zeolites
advantages of, 1560
Bentonite clays as aid to, 501
boiler feed water, 655, 951
carbonaceous zeolites for, 958
first municipal plants for, 1873
Minneapolis, Minn., plant, 1547
Soil; *see also* Corrosion
factors in corrosion, 1635
laboratory test of, 760
testing prior to pipe laying, 746
Spartanburg, S. C., summer sprinkling rates, 1277
Specifications; activated carbon; final report on, 1133
specimens of, 1195
chlorine, review of, 1671
clay, for water conditioning at Atlanta, Ga., 1537
coating, pipe, 1643
laying cast iron pipe, 215
lead for pipe jointing, 227
meter; discussion of, 981
in Netherlands, 643, 647
pumps, deep well, 2071
Springfield, Ill., water works, moving of, 585

Sprinklers, automatic; *see also* Fire service, Rates
efficiency of, 583
relation of water works to, 580
Sprinkling, lawn, *see* Irrigation
Standpipe, *see* Tank
Statistical reports for water works, 507
Steam power for pumping, reliability of, 1696
Steel; *see also* Pipe
pipe, experiences with at Washington, D. C., 1780
Sterilization; *see also* Chlorination, Silver, Treatment
of water mains, 235, 1471
silver and ammoniated silver, by 131
Sulfur; jointing compounds, 1782
mining, water supply for, 651
Swimming pool, sterilizing by silver and ammonia, 131

Tank; *see also* Reservoir
circular, settling, study of, 335
concrete, at Sacramento, Calif., 402
distribution, study of at Fresno, Calif., 416
failure of, unusual, 1971
Taste; *see also* Activated carbon
characteristics of water, 485
control by clay, 1528
Temperature variations related to treatment, 793
Toledo, Ohio, sub-surface filters, 826
Toronto, Ont., drifting sand filters, 2049
Treatment, water; *see also* Activated carbon, Aeration, Algae, Ammonia, Bentonite, Boiler, Chloramination, Chlorine, Coagulation, Color, Copper, Copperas, Corrosion, Filter, Iron, Lime, Odor, Sedimentation, Silver, Sodium, Softening, Sterilization, Zeolites
Canadian practice in, 2030
mathematics of, 2052
Neenah, Wis., at, 600
Oshkosh, Wis., 594
related to temperature, 793
Wheeling, W. Va., 112
Truck, repair, for Minneapolis, 1974
Tuberculation, *see* Corrosion
Tunnel, water, at Ford plant, 68
Typhoid; in cities of U. S. in '37, 1456
survival of in nature, 124

United States; *see also* Federal
Treasury standard for water, 244
Utica, N. Y., chloramination prevents tuberculation, 1885

Valuation theories, 478
Valves; action of in pipes, 1858
altitude, 1520
automatic, various types, 1514
check, 1871
cone, 1390, 1858
inspection of, 1951, 1958
power operating device for, 1974
pressure reducing, 1517
research in design of, 1989
Vera Cruz, Mex., water works, 1125

Washington, D. C., experiences with c.i., steel, concrete mains, 1780
Waste, *see* Leakage
Water; analyses; Long Island, 307
number required to avoid error, 496
published collections of, 497
analysis; *see also* Hardness
calcium and magnesium, for, 1040
Cuban practice in, 1341
lactose broth, modified for, 979
method and medium, new, at Los Angeles, 2010
plating medium, new; for coliform, 1808
application to water and sewage, 1821
chemical characteristics and spectroscopy of, 1433
consumption; *see also* Air conditioning
Cincinnati, Ohio, at, 1718
Cuban, 1337
effect of meters on, 872, 876
Fresno, Calif., at., 417
increases recorded, 879
Indianapolis, Ind., at, 872
St. Louis, Mo., at, and pumpage, 886
sewer rental based on, 1288
special rates to promote, 1265
damage suits, 613
department; control of plumbing, 1775
co-operation with fire dept., 1957
from the air, 454
ground, *see* Ground water
hammer; caused by valves, 1864
Mexican studies of, 1120
relief from, 15
heavy, 1434
meters, *see* Meter
methane in, 1828
mineral salts in, 242, 495
rates, *see* Rates

resources, *see* Water supplies, Federal
supplies; Central Valley, Calif., project, 389
chemical character of, 495
desirable characteristics of, 484
industrial; *see also* Industrial
in Canada, 137
Long Island, ground water, 289, 302, 319
New York City, of, from Long Island, 298
Nova Scotia, 152
sulfur mining, for, 651
supply engineering (publication), 1886
unaccounted for, reduction of, 10
works; *see also* Treatment
accounting, *see* Accounting
Arlington Co., Va., at, 1938
Birmingham, Ala., at, 56
Cayuga, N. Y., at, 273
Charlottetown, P. E. I., at, 160
Cold Water, Mich., at, 1929
Cuban, 1335
East Helena, Mont., at, 557
employees; *see also* Licensing, Schools
as good will agents, 1919
merit system for, at Dallas, Tex., 1540
training of, 1595, 1991
executive, the, and his community, 721
Fresno, Calif., study for tank, 416
Houston, Tex., at, 1092
Los Angeles, Calif., supply, rates, etc., 913
management by commission, 1926
Mexico City, Mex., at, 1116
New Orleans, La., at 1103
New York City, on Long Island, 298
one man town, in the, 557
operating a small, 1929
operating kinks, 112
operators, manual for (publication), 2081
Palmyra, N. Y., at, 280
practice, recent developments in, 453
relation to automatic fire protection, 580
reliability of, 1949
Sacramento, Calif., tanks at, 402
St. Stephen, N. B., at, 164
Springfield, Ill., moving of, 585
statistics, reports for, 507
structures, of treated lumber, 784
unbalanced capacity of, 878
Vera Cruz, Mexico, at, 1125
Winnipeg, Can., at, 1872
Welding tanks at Sacramento, 411
Well; *see also* Ground water
cleaning with dry ice and acid, 1764
construction; and pumping of, 455
at Houston, Tex., 1098
contracts, guaranteed, ethics of, 574
depth tubes for, 2075
diffusing, for recharging ground water, 1755
Fresno, Calif., at, 416
gravel wall, at Cold Water, Mich., 1932
Long Island, 304
New York City, 299
pumps; specifications and testing of, 2071
submersible, 1399
sterilization and cleaning, 1130, 1764
Wheeling, W. Va., operating kinks, 112
Winchester, Va., leakage reduction, 1787
Winnebago, Lake, treatment of water of, 594
Winnetka, Ill., hood for water inspection, 121
Winnipeg, Canada, water supply of, 1872
Wisconsin; uniform systems of accounts in, 1978
University of, fluid impact arrester, 19

Zeolite; *see also* Softening, Treatment
carbonaceous, 947
hydrogen, 949
softened water, corrosivity correction of, 1375, 1384
Zinc, salts in water, 254, 492

AUTHOR INDEX

ACKERMAN, J. W., *discussion*—corrosion control, accomplishments with chloramination, 1385
ADAMS, A. L., uniform systems of accounts, 1978
ADAMS, R. B., manganese and iron deposits on filters, 1836
ALARCON, D. G., water supply system of Vera Cruz, 1124
ALEXANDER, C., *discussion*—use of sodium silicate in corrosion control at a rayon plant, 1386
ALLTON, R. A., sewer rental method of sewerage financing, 1285
AMISS, T. L., *discussion*—meeting air-conditioning demands, 883
ANDERSON, L. W., laying water mains and services, 612
ANDERSON, S. T., AND SPAULDING, C. H., moving the Springfield water works, 585
ANGUS, R. W., action of valves, 1858
APPLEBAUM, S. B., applications of carbonaceous zeolites to water softening, 947. *Discussion*, 977.
ARNOLD, G., ethics of contracts guaranteeing well capacity, 574
ASHLINE, R. R., testing of soils prior to installation of pipes, 746
ATKINSON, G. E., distribution reservoirs, 432

BABBIT, H. E., recent developments in water works practice, 453
training of the sanitary engineer, 1595
BARTLING, H. A., factors in selection of pump motors, 567
BAYLIS, J. R., *discussion*—activated carbon application, 1330
BEARD, P. J., survival of typhoid in nature, 124
BECKETT, H., experiences with cast-iron, steel and reinforced concrete mains, 1780
BEHRMAN, A. S., *discussion*—applications of carbonaceous zeolites to water softening, 974
BERK, A. A., *see* SCHROEDER, W. C.
BILLINGS, L. C., specifications and tests for powdered carbons, 1234
BIRD, F. W., *see* CALDWELL, W. E.
BLACK, E. B., rates, valuation, and water ordinances, 472
BLIVEN, C. H., unusual standpipe failure, 1971
BLOMQUIST, H. F., *discussion*—sewer rental method of sewerage financing, 1295
BOLLEN, W. B., *see* CALDWELL, W. E.
BOOTH, G. W., adequate hydrant distribution, 1855
BORGMANN, C. W., treatment of waters to control corrosion, 265
BRAIDECH, M. M., mechanics of adsorption by activated carbon, 1299
BREAZEALE, E. L., AND GREENE, R. A., determination of calcium and magnesium by soap titration, 1040
BROWN, K. W., AND VILLARRUZ, P. A., improvements in the soap solution method for determining hardness, 1021
BROZ, F. J., AND DIAMOND, G., reducing unaccounted-for water, 10
BURNS, H. S., AND SMITH, H. A., water problems in the mining of sulphur, 651
BURNSON, B., seasonal temperature variations in water treatment, 793
BUSWELL, A. M., water isn't H_2O, 1433
microscopic growths in distribution systems and their food supply, 1651

CALDWELL, W. E., BOLLEN, W. B., BIRD, F. W., AND OSLER, G. F., silver ion and ammoniated silver ion as sterilizing agents in a swimming pool, 131
CANARIIS, S. A., automatic pumping equipment, 1388
CARNS, J. G., meter maintenance, 515
CHARLES, R. S., JR., pressure filters for iron removal, 1507
CONKLING, D. W., new development in deep well pumping, 1399

COOK, R. E., *discussion*—quality of underground waters on Long Island, 319
COONEY, R., the water works executive and his community, 721
CORNELL, G. B., elevated storage for the Fresno City Water Department, 416
COSCULLUELA, J. A., water supply systems in Cuba, 1335
COWLES, P. B., modified lactose broth, 979
CRANCH, E. T., main cleaning in New Rochelle, 1964
CUNNINGHAM, G., electrolysis, 1767

DARNELL, G. O., water company field representatives, 864
DAVIS, D. E., *discussion*—correcting corrosivity of zeolite softened waters, 1375
DAWSON, F. M., AND KALINSKE, A. A., control of water piping from main to consumer, 464
DEAN, J. B., *discussion*—electrolysis, 1451
DECKER, A. C., Birmingham industrial water supply, 56
DECKER, A. C., AND JAGGER, J. E., Chickasaw, Ala., filtration plant, 1655
DEMARTINI, F. E., corrosion and the Langelier calcium carbonate saturation index, 85
DENNETT, R. C., fire protection for small towns, with special reference to pumping equipment, 563
DES BAILLETS, C. J., reinforced concrete pressure pipe for Montreal, 1478
DEWELL, H. D., AND HOSKINSON, C. M., three million gallon elevated storage tanks, 402
DIAMOND, G., *see* BROZ, F. J.
DODD, R. I., *discussion*—use of clay in coagulation and taste and odor control, 1538
DUGGER, E. F., should plumbing installations be approved by the water department, 1775
DULMAGE, W. W., raw water supply of Ford Motor Company, 67

EARL, G. G., *discussion*—New Orleans water supply, 1111
ELMENDORF, C. E., Cayuga filter plant, 273
END, W. F., automatic valves, 1514
ERICKSON, D. L., *discussion*—meeting air-conditioning demands, 881
ERWIN, T. M., business procedure in the water sales division, 913
discussion—metering aids administration, 1721

FABER, H. A., *discussion*—chlorine specifications and accidents, 1681
FABRIN, A. O., *discussion*—new development in deep well pumping, 1407
FELLOWS, C. H., *see* SCHROEDER, W. C.
FIEDLER, A. G., *see* THOMPSON, D. G.
FIELD, A. M., distribution system leakage, 1787
FORD, J. L., AND FORD, R. V., meter testing, 940
FORD, R. V., *see* FORD, J. L.
FRISK, P. W., boiler water treatment, 1630

GALLAGHER, C. A., *discussion*—meter specifications, 981
GAULER, J. V., *see* OLIN, H. L.
GAYTON, L. D., air conditioning in Chicago, 892
GLACE, I. M., *discussion*—calcium carbonate units and corrosion control, 1366
GOIT, L. E., *see* HURLBUT, W. W.
GOUDEY, R. F., water bacteriology, 2010
GOUGH, J., the one-man town, 557
GREENE, R. A., *see* BREAZEALE, E. L.
GRODSKY, V. A., laboratory soil corrosion test, 760
GROSS, D. D., *discussion*—electrolysis, 1453
GURCK, A. J., water meters, 617
discussion—meter practice in Holland, 650

HALE, F. E., *discussion*—iron removal, 1503
HARDING, J. C., specifications and testing of deep well pumps, 2071
HAYES, H., JR., *see* HURLBUT, W. W.
HEDGEPETH, L. L., and RIGGS, W. S., chlorine specifications and accidents, 1671
HELBIG, W. A., threshold odor and phenol value tests for activated carbons, 1225
activated carbon dosage, 1320
HENNING, H. C., can purchased electric or Diesel power be as reliable as steam power for pumping?—steam power, 1696
HERBERG, S., fire protection elements of water works, 1946

HINMAN, J. J., JR., desirable characteristics of water, 484
HINTZ, A. E., *discussion*—treatment of Lake Winnebago water, 605
HOFFMAN, M. F., metering aids administration, 1716
HOLLERAN, O. C., increases in water demand, 875
HOOVER, C. P., the Langelier method, 1802
HOPKINS, E. S., *review*—"manual for water works operators," 2081
HOSKINSON, C. M., *see* DEWELL, H. D.
HOWSON, L. R., treatment of Lake Winnebago water, 594
well water problems of Houston, 1092
HUBBELL, G. E., hydraulic characteristics of circular settling tanks, 335
HUDSON, H. E., JR., filter materials, filter runs and water quality, 1992
HUGHES, G. F., *discussion*—special summer sprinkling rates and off-peak rates for other purposes, 1283
HULBERT, R., mathematics of water treatment, 2052
HURLBUT, W. W., HAYES, H., JR., AND GOIT, L. E., *discussion*—soil corrosion and pipe protection, 1648
HURLBUT, W. W., can purchased electric or Diesel power be as reliable as steam power for pumping?—general considerations, 1699
HYATT, E., the central valley project, 389

INGLEE, C., the dollars and sense of main cleaning, 773

JACKSON, L. A., financing main extensions, 1
JAGGER, J. E., *see* DECKER, A. C.
JENSEN, J. A., softening at Minneapolis, 1547
emergency repair truck for Minneapolis, 1974
JEWELL, I. H., development of filtration to increase capacity, 817
JONES, W. M., automatic fire protection, 580
JONGEPIER, P., *discussion*—meter practice in Holland, 649

KALINSKE, A. A., *see* DAWSON, F. M.
KENDALL, V. V., *see* SPELLER, F. N.
KESSLER, L. H., relief from water hammer, 15
KINNEAR, J. M., laying 30-inch subaqueous main under Curtis Creek, Baltimore, 1791
KLEIN, W. I., *discussion*—iron removal, 1502
KNUDSEN, H. A., cathodic protection of the Mokelumne aqueduct, 38
KUHN, R. J., *discussion*—corrosion prevention by cathodic protection, 1448
KURANZ, A. P., *discussion*—meter specifications, 988

LAASE, W. F., New York City's Long Island sources, 298
LADUE, W. R., *discussion*—special summer sprinkling rates and off-peak rates for other purposes, 1278
LAFLIN, A. A., water supplies of the maritime provinces, 164
LAMAR, W. L., chemical character of waters, 495
LAMB, C. H., continuing property record, 1616
LANGELIER, W. F., *discussion*—the Langelier method, 1806
LARSON, T. E., properties and determination of methane in ground waters, 1828
LEIPOLD, C., hood for water observation, 121
LENDALL, H. N., hydraulics and water works engineering, 2063
LEVERIN, H. A., industrial waters in Canada, 137
LEY, P., iron removal plant, 1493
LINDLSEY, D. L., treated lumber in water works structures, 784
LITTMAN, M. L., AND STARK, C. N., new plating medium for coliform analysis, citrate ricinoleate agar. I. Development and theory, 1808
LITTMAN, M. L., new plating medium for coliform analysis, citrate ricinoleate agar. II. Application to water and sewage, 1821
LONGLEY, F. F., *discussion*—reinforced concrete pressure pipe for Montreal, 1489
LUNDBERG, A. T., Arlington County water system, 1938

MACMILLAN, J. A., water works of the maritime provinces, 160
MATHEWS, H. T., the plant ledger, 1627

McDONNELL, R. E., *discussion*—special summer sprinkling rates and off-peak rates for other purposes, 1265
McDONNELL, R. H., can purchased electric or Diesel power be as reliable as steam power for pumping?—Diesel power, 1690
McKAY, R. D., Nova Scotia water supplies, 152
McQUEEN, L. E., operating a small water works, 1929
MEITES, H. L., safeguarding water revenue, 1723
MICHAEL, A. C., statistical reports for water works, 507
MILLER, A. P., plumbing hazards and their evaluation, 1702
MILLER, W. T., private fire lines in New York State, 1847
MILLS, F. R., accounting in small water plants, 898
MITCHELL, J. A., meter maintenance, 930
MOLINA, E., water supply of Mexico City, 1116
MOORE, C. E., *discussion*—should plumbing installation be approved by the water department, 1779
MOREHOUSE, E. W., changes in water utility accounting, 1605
MOREHOUSE, W. W., *discussion*—sewer rental method of sewerage financing, 1291
MURDOCH, J. H., JR., private fire service charges, 1668

NASON, H. K., chemical methods in algae and slime control, 437
NEGUS, S. S., physiological aspects of mineral salts in water, 242
NEWSOM, R., charges for private fire protection, 1665
NIEMEYER, H. W., the human element in meeting emergencies, 855
NILES, P. B., watering the grass roots—public relations, 1917
NORCOM, G. D., quality of underground waters of Long Island, 302
discussion—effectiveness of chemical treatment for control of pipe corrosion, 1353
see also WIGGIN, T. H.
NUNN, H. E., *discussion*—business procedure in the water sales division, 928

OLIN, H. L., AND GAULER, J. V., bentonite clays, 498
OLSON, H. M., *discussion*—corrosion control, experience with zeolite water plants, 1384
OSLER, G. F., *see* CALDWELL, W. E.

PIRNIE, M., *discussion*—softening at Minneapolis, 1565
PLANK, J. J., viewpoint of the water commissioner, 1926
POOLE, B. A., sterilization of distribution systems, 1471
POTTER, A. A., *discussion*—research—an essential tool, 1991

RIGGS, W. S., *see* HEDGEPETH, L. L.
RIPPLE, O. J., coal versus sand as a filter medium, 812
ROOS, C. M., *discussion*—meter testing, 944
RUSSELL, A. A. M., protection of metals to resist corrosion, 767

SANFORD, J. H., diffusing pits for recharging water into underground formations, 1755
SCHNEIDER, J. H., *discussion*—meter practice in Holland, 649
SCHROEDER, W. C., BERK, A. A., AND FELLOWS, C. H., intercrystalline cracking in boiler steel, 679
SCHROEVERS, G., *discussion*—meter practice in Holland, 649
SCHWARTZ, M. C., removal of silica from water for boiler feed, 659
SCHWARTZ, W. J., a list of retirement units, 1623
SCOTT, W. M., water supply of Winnipeg, 1872
SIMMS, R. B., *discussion*—special summer sprinkling rates and off-peak rates for other purposes, 1275
SMITH, H. A., *see* BURNS, H. S.
SMITH, M. C., activated carbon application efficiency, 1325
SPAFFORD, H. A., *discussion*—properties and determination of methane in ground waters, 1834
SPAULDING, C. H., *discussion*—softening at Minneapolis, 1563
see also ANDERSON, S. T.
SPELLER, F. N., AND KENDALL, V. V., soil corrosion and pipe protection, 1635
SPELLER, F. N., *discussion*—soil corrosion and pipe protection, 1650
SQUIRE, A. B., Palmyra filter plant, 280

STAPLEY, E. R., licensing of plant operators and superintendents, 78
STARK, C. N., *see* LITTMAN, M. L.
STRICKLAND, G. H., filtration practice in Canada, 2030
SUTER, M., sterilization and cleaning of a well with chlorine and dry ice, 1130
SUTER, R., underground waters of Long Island, 289

TATNALL, G., fire protection and the distribution system, 1953
THAYER, S., corrosion prevention by cathodic protection, 1442
THEARD, A. F., water supply of New Orleans, 1103
THOMPSON, D. G., AND FIEDLER, A. G., legal control of ground waters, 1049
TIBBETTS, F. H., ground water replenishment, 326
TODD, A. R., operating kinks, 112

VANCE, L. S., *discussion*—meeting air-conditioning demands, 884
VAN RANDWIJCK, F. G., *discussion*—meter practice in Holland, 649
VAN ROYEN, R. P., standardization of water meters—discussion of the Dutch specifications, 643
discussion—meter practice in Holland, 647
VILLARRUZ, P. A., *see* BROWN, K. W.

WALLACE, L. W., research—an essential tool, 1986
WARING, F. H., prevention of corrosion by inhibitors, 736
WEIR, P., use of clay in coagulation and taste and odor control, 1528
WEIR, W. V., *discussion*—meeting air-conditioning demands, 886
can purchased electric or Diesel power be as reliable as steam power for pumping?—electric power, 1684
WEISSE, F. W. E., *discussion*—meter specifications, 986
WIGGIN, T. H., AND NORCOM, G. D., corrosion control—studies and operating experiences, 1342
WIGGIN, T. H., corrosion control, engineering and economic aspects of pipe corrosion, 1343
WILBUR, C. C., *discussion*—sewer rental method of sewerage financing, 1293
WINDER, J. B., *discussion*—special summer sprinkling rates and off-peak rates for other purposes, 1282
the merit system of Dallas, Texas applied to water works employees, 1540
WOLBERT, H. E., public relations of a municipally owned plant, 1923
WOLMAN, A., *review*—"elements of water supply engineering," 1886

ZUFELT, J. C., handling and feeding activated carbon, 607

ABSTRACTED ARTICLES

SUBJECTS

See also Index of Abstract Topic Headings, page 2136.

Accounting; *see also* Collection, Financing
Stratford, Ont., water works, 541
Acetyl-methyl-carbinol fermentation and its significance, 844
Acidity in pond water, 1420
Activated carbon; evaluation, 996
experiments, 997
growth of use, 996
Aeration and chlorination of mineral water, 531
Agar-agar, introduction of into bacteriology, 842
Air-conditioning; Phoenix, Ariz., domestic, 702
water demand of, 540
water demand over-estimated, 540
Air content of water, determination, 189
Air tools in water works maintenance, 1252
Air valves for plumbing, 2094
Algae; *see also* Daphnia, Freshwater Biol. Assn.
control; by heated copper sulfate solution, 995
in cooling systems; 1420
by chlorine, 995
growth; in margins of ponds, 993
of Lake Windermere, 994
related to sunshine, 993
Algerian rockfill dams; 380
substructures of, 1905
Altona, Ger., change to ground water supply, 1578
Alumina, hydrous, colloidal properties, 185
Aluminum determination; 1740
by fluorescence, 1741
colorimetric, with alizarin, 188
in presence of fluorides, 1742
quantitative, by precip. with urea, 841
Amebiasis affected by exposure, 1241
Ammonia determination; and detection, 184
by Nessler reagent,—sources of error, 185
in drinking water, 838
Ammonium aurintricarboxylate preparation, 1741
Annual reports, *see* Des Moines, Erie, London, Madras, Maryland, New Bedford, Ohio, Pasadena, Rand, St. Louis, Shanghai, Tientsin, Water pollution research board
Antimony determination in alloys, 1739
Arsenic; detection and removal, 1739
determination in alloys, 1739
in water supply, 1007
poisoning, 1007, 1427
Asphalt for reservoir lining, 1255
Association,—water works, value of, 195
Augusta's new filter plant, 2102
Austrian water supplies, 1578
Automatic control symposium, 715

Back-siphonage in plumbing fixtures, 365
Bacteria pyocyaneum as index of pollution, 1422
Bacterial; *see also* Agar-agar
control of water supplies, 1571
counting, improved plate for, 845
freezing, effect on bacteria, 1424
relation to plankton, 842
Barium, sulfur and sulfates determination, 840
Base exchanging resins, 837
Bellingham, Wash., supply extension, 704
Bends, pipe; as flow meters, 1012
flow in, 1752
losses in, 1753
Bentonite used for sealing pond bottoms, 196
Bird protection for reservoirs, 709
Bismuth, sulfite medium (Wilson & Blair), 1423
Blasting primer, safety, 1913

Boiler; *see also* Caustic, Chloride, Corrosion, Sodium
corrosion; control, 1262
investigation by Bur. of Mines, 1901
prevention by lignin, 1901
feed with Ramzin system, 173
intercrystalline cracking of, 548, 1260
scale; formation below boiling, 1748
prevention by colloids, 1902
stand-by, corrosion prevention in, 1900
steam, salt content of, 1261
superheater corrosion treatment, 1262
water; deaeration, 172
experiments, 1257
foaming and priming; 548, 1255
survey of articles on, 173
oil in, test for, 1261
treatment; 173, 174
Cape Breton, Can., at, 548
electrolysis in the boiler, by, 174
high pressure 172
Lockland, Ohio, at, 1260
Rochester, at, 1258
Boron determination, effect of glassware, 189
Boston's Quabbin aqueduct, 1910
Bridge, suspension, for pipe, 1911
Brisbane, Australia; automatic filter wash, 849
filter plant, 2102
British; Inst. of C. E., Research Comm. Report, 1916
public health act of 1936, 196
water supply; and planning, 539
engineering reviewed, 695
questions, 1572
works construction reviewed, 695
Bromides, and chlorides, determination, 840
Buenos Aires; loses water in offshore wind, 194
supply from La Plata R., 1577
Bureau of Mines investigation of boiler corrosion, 1901
Buret filling device, 373
Burnhope reservoir opened, 196

Cadmium poisoning, 1428
Cairo, Ill.; swimming pool, 852
treatment plants, 998
Cajalco reservoir construction, 1907
Calcium and magnesium; determination, 839
effect in cooking vegetables, 1007
estimated volumetrically, 1738
Hehner's method for determination of, 187
California; treatment practice forecasted, 999
Water Service Co., system improvements, 707
Cambridge, Eng., meter shop and regulations, 545
Canadian; *see also* Ontario
industrial waters, 168, 1731
water works; data, 1415
officials, 1413
statistics, 1416
Cannery; wastes treatment, 172
water supplies, 167, 168
Cape Town purification plant, 2108
Carbon, *see* Activated carbon
Carbonates, titration of, 840
Carbon dioxide; absorption, 841
removal at Centreville, Miss., 2107
Cast iron; strength, influence of corrosion on, 1749
vs. steel for mains, 1248
welding, 384
Catadyn; *see also* Silver
sterilization; 1594
of food stuffs, 847
water action on bacteria, 847
Caustic embrittlement, causes and prevention, 1900
Cavitation and erosion resistance of alloys, 1262, 1263
Cedar Rapids water department organization, 359
Cement lining; *see also* Coatings, Concrete, Pipe
and reclamation of pipe, 1912
cost, 1247
for steel pipe, 1751
48″ pipe in place, 1247
in San Francisco, 1249
machine for, Argentinan, 1751
Toronto welded steel pipe, 706, 1250, 1579
Central Valley (Calif.) reclamation, 555
Chicago filter plant to be started, 1574
Chickamauga dam foundations and design, 199
Chloramination; *see also* Chlorination
installation, record size, at San Francisco, 180
of chalk wells in England, 1592
Chlorides; and bromides, determination, 840
in boiler water, determination, 548
Chlorination; *see also* Chloramination, Chlorine

automatically recorded and regulated, 1735, 1743
Germany, in, 25 years of, 180
Ontario, Can., practice in, 180
Werden method, by, 368
Chlorinated copperas at Dallas, Tex., 530
Chlorinator design, Soviet, 1593
Chlorine; *see also* Chlorination
determination; 180
photoelectrically, 1742
flow through capillaries, 1593
free, determination in water, 846
germicidal properties of compounds, 1594
handling at Jamaica, N. Y., sewage plant, 846
leaks, controlled by immersion in soda, 179
manufacture and use, 1592, 1593
phenol, action on, 1594
-water vapor, stability in light, 1743
Cincinnati, Ohio; new treatment plant, 2101
water system, 2101
Clarification, mechanism of action by strychnos potatorum seeds, 1001
Coagulation; at Dallas, Tex., 530
novelties, 530
use and feeding in Canada, 848
Coatings; *see also* Cement, Paint
bituminous; in Great Britain, 849
in the U. S., 849
pipe, 1245
testing, 176
thickness measurements, magnetically, 1750
Cold weather protection for water works; 195, 1911
at Eau Claire, Wis., 702
at Ottawa, Can., 194
Coli, Esch.; heat resistance of, 1590
isolation of, 845
lactose fermenting power, change in, 845
Coliform organisms; action with erythrosin, 1422
and water supplies, 1242
detection of H_2S in, 843
detection, study of comparative methods of, 1421
differentiation by nitrogen availability, 843
in human feces, 1588, 1589
significance in water, 1422
Collection of delinquent accounts in Boston, 2085
Color removal from humic ground waters, 2109
Colorado river; aqueduct; bid prices for, 200
feeder lines from, 1910
water, suitability for citrus, 999
Concrete; *see also* Cement, Grouting, Leaching, Reservoir
in swamp water, 202
permeability, 1016
pipe; coating machine, 850, 1246
pressure, 1249, 1581
tests of steel stresses in, 202
tanks; adjustable, 1254
expansion joints for, 1254
experience with in New England, 2099
in England, 2098, 2098
Consumption; customer notified of high, 2086
limitation of for car washing, 363
Copper; alloys for service pipe, 207
and lead poisoning from pipe in Conn., 833
detection, 1740
detection and determination, 834
determination in dairy products, 834
pipe, loss of iodine in, 1428
-silicon alloy for hot water, 1263
solubility, in pipe, 833
Cork, Ireland, water treatment, 528
Corporation cock reinforcing used at Los Angeles, 2096
Corpus Christi, Tex., pipe bids, 386
Corrosion; *see also* Boiler, Cavitation, Electrolysis, Lead, Soil
control by; cathodic protection, 177
electrolytic method, 1262
control in; distilleries, 851
hot water systems, 1748
refrigeration plants, 174
due to; concentration cells, 1902
dissolved oxygen, 1245
sulfate reducing bacteria, 177
thermal currents, 1262
water, determination of, 1747
neutralization, 850
of; boiler steel, and cracking, 1260, 548
bronzes, 546
cast iron, Dutch experiments, 1243
condenser tubes, 1261
galvanized heater tanks, 177
galvanized iron due to copper pipes, 1747
hot water tanks and plumbing, 175
mains and services, 546
pumps, causes of, 1899
resistance of welded joints, 1245

soil; 175, 176
of pipe, 1749
treatment; at Cambridge, Mass., 851
for hot water systems, 176
Counting device for plankton, 1420
Couplings, fluid, for power transmission, 1264
Crooksville, O., water supply, 192
Cross connections; *see also* Plumbing
control in Georgia, 2094
elimination in Los Angeles, 365
examples of, 1004
experiences and regulation in Quebec, 1004
in plumbing; 365, 720, 2093
the water purveyor's interest in, 365
special equipment for, 364
Croyden, Eng., typhoid epidemic, 852, 1242
Crushing strength of granules, apparatus for testing, 373
Customer relations, fairness in, 2086

Dams; *see also* Algerian, Asphalt, Bentonite, Burnhope, Cajalco, Chickamauga, Derwent, Drilling, Eildon, Fernilee, Fill, Grand Coulee, Grouting, Parker, Seattle, Seepage, Seminoe, Shasta, Spillways
Ambursen, in Nova Scotia, 1013
arch; earthquake stresses in, 379, 1905
vs. gravity, 379
construction in '37 abroad, 1014
earth, at Butler, N. J., 1015
earthquake stresses in, 1905
failure of; 197
Wyandotte Co. lake, 1017
gravity, twist action in, 554
laboratory in France, 1015
Morris, tests to resist earthquake, 1906
rock fill; design, 379, 1902
subsidence of, 555
shearing stresses in, 1016
Torquay Corp., for, 198
Daphnia, effects of salts on, 1418
Dartmoore, Eng., watershed characteristics, 1891
Dayton, Ohio, water supply system, 537
Debt, municipal, of 286 cities, 1574
Denver's trans-mountain diversion, 538
Derwent river dam (Eng.), 197
Desert water supplies in India, 1417
Des Moines, Iowa; water works, 703
annual report for '37, 361
Diesel engine exhaust gases, 1899
Disease; *see also* Amebiasis, Dysentery, Fluorosis, Gastro-enteritis, Typhoid
water-borne, 853, 2089
Distillation methods for water, 838
Distribution; *see also* Main, Pipe
economics in rural areas, 1248
mains, materials and jointing, 1249
pipe sizes, 382, 1011
system; analysis, discussion, 707
design, 382, 1010, 1247
problems, solution of, 1247
survey at Lima, Ohio, 2098
Drilling, exploratory, for dam foundations, 1015
Drinking fountain regulation in Connecticut, 2093
Drought; *see also* Hydrology
of '36, W. S. Paper 820, 1889
Durban (Natal) new supply, 1579
Dusseldorf, Ger., private water supplies, 698
Dusting reservoirs with chemicals, 2104
Dysentery; at Amsterdam, 2093
prevalence in England, 1005

Edinburgh filter plant extension, 370
Eijkman medium modification, 1591
Eildon dam repairs (Australia), 1018, 1019
Electrode, glass, durable, 373
Electrolysis; *see also* Corrosion
by galvanic currents, 545
protection; 176
of a condenser, 1902
Endamoeba histolytica cysts, vulnerability to chlorine, 1742
Erie, Penna., annual report, '37, 1729
Etobicoke, Canada, softening plant, 830
Eureka, Calif., water project, 704

Federal financing of water works by P. W. A., 540
Fernilee, Eng., reservoir, 197
Ferric thiocyanate color intensity, 841
Fiber water pipe, 1253
Fill compaction with cohesionless material, 1908
Filter; *see also* Augusta, Brisbane, Cairo, Cape Town, Chicago, Cincinnati, Edinburgh, Greenfield, Magno, Marshall, Sand, Sieving, Softening

circular, steel, at Bristol, Conn., 2107
cleaning with sulfur dioxide, 370, 2100
control tables, central, 370
Edinburgh, Scotland, at, 528
flow through, 849, 2100
marble in Netherlands, 530
practice; in Canada, 848, 2109
in '37, 848
Salem and Beverly, 369
small, 367, 2101
Financing; France, small water projects in, 2085
main extensions in Hartford, Conn., 2084
municipal credit as basis for, 2083
Public Works Administration, by, 540
revenue bonds, by, 2083
savings, by, of water works improvements, 540
Fire protection; cost of water works justified by insurance savings, 542
in New Jersey cities, 1573
in San Francisco, 542
Fish killed by oxygen excess, 1420
Flood; *see also* Hydrology, New England, Orange Co., River, Stream
control; Ontario, 1009
works, 717
forecasts by weather bureau, 377, 1890
meteorological conditions during, 376
prevention and river control, 378
public health during, 2091
run-off from small areas, 377
southern California, 1009
storms producing, 375
works on Mississippi R. in '37 flood, 1009
Florida; water supplies, 1731
waters, treatment of, 1414
Fluorescein persistence to leaching, 185
Fluorides; *see also* Fluorosis
adsorption by alum floc, 367
detection by etching test, 370
determination; 1738, 1739
by photocell, 183
colorimetrically in water, 1738
facts, 834
food products, in, 1006
health, effect on, 1006
in; Alberta, Can., 364
Chicago, suburb, 364
New Mexico, 1425
milk content is low, 182
mineral water content, 835
reagent, new, 186
removal; 182
calcium phosphate, by, 835, 835
Iowa studies on, 1000
phosphate, by, 2104
teeth, effect on, 1425
titration in aqueous solution, 836
Fluorosis; *see also* Fluorides
India, 181, 363
Madras, India, 363
Ohio, 181
Food; containers, paper; microbial flora of, 2089
suitable, 2089
handler examination discontinued; in Hartford, Conn., 2087
in New York, N. Y., 2087
poisoning, case of, 2088
Frankfurt, Ger., deacidification plants, 2106
Fungus in copper sulfate bath, 995

Gages; *see also* Automatic control and meters for various purposes, 1002
Galvanizing, testing of, 177
Gas; illuminating; as boiler fuel, 1898
holder water treatment, 851
various; dissolved in water, determination of, 838
solution in water, 184
Gastro-enteritis; *see also* Disease, Milwaukee
further discussion of, 1240
in a Tennessee town, 1242
Vinton, Iowa, 2092
German; chemists' society, water chemistry proceedings, 366
chlorination practice, 25 years of, 180
meter standardization, 698
water; resources statistics, 1417
softening conditions, 178
supplies, 697
Grand Coulee dam; 1014
completion bids asked, 199
Graphite purification for spectrometry, 842
Greenfield, Mass., slow filters, 369
Groningen, Holland, provincial water supply, 354
Ground water; *see also* Infiltration, Methane, Wells
flow formulas, 1895, 1896
heavy water content of, 1898

of; chalk formations, England, 552
Eure-et-Loir, France, 1432
Florida, 1730
Needham, Mass., 711
North Dakota, lowering of, 551
Paris basin, France, 1432
Parlin, N. J., report on, 1431
Swakop R. bed, composition, 1897
the south, 1431
pollution; by bored hole latrines, 710
by drainage wells, 1430
studies of, 1891
regulation; administrative, 204
in England, 1897
replenishment in California, 1430
sanitary surveys, 1895
Grounding, electric; *see also* Electrolysis
on water pipes, 387, 2096
Grouting; *see also* Concrete, Dams
an earth dam, 555
pumps, servicing, 1017
to stop dam leakage, 1908
Gunite reservoir lining at Danvers, Mass., 1583
Gypsy moth control, 195

Hammersmith, Eng., pump station of Metr. W. Board, 549
Hanger for pipe, 386
Hardness; *see also* Softening
advantages of in water, 1746
determination; by Blacher's method, 188, 1737
comparison of methods, 1736
temporary, determination of, 186
Harvard sanitary research laboratory, 2110
Head water forecasting, 377; *see also* Hydrology
Heavy water content of deep ground water, 1898
Holland, *see* Netherlands
Holland, Mich., tank improves supply, 1253
Hooker cell, the, for chlorine generation, 1593
Hotel water supply (Fr.), 534
Houston, Texas; water plan approved, 1020
water supply report, 1574
Hydrant; breakage experience, 1252
flush, new British specification for, 207
locations with dual mains, and valve, 1581
railroads, used by, 708
specifications, 1251
Hydraulics; *see also* Bends, Distribution, Orifice, Pipe, Pump, Water hammer, Weir
fluid turbulence, modern conceptions of, 212
friction loss nomograms, metric, by European formulas, 211
knowledge, 1013
laboratory at Univ. of Washington, 1915
model studies, 1012
open channels with adverse slope, 373
salt solution measurement of flow, 1012
short channel flow, 718
Hydrogen ion concentration; *see* pH
Hydrogen sulfide, detection in cultures, 843, 1592
Hydrology; *see also* Drought, Flood, New Orleans, Rain, River, Runoff, Stream
of East Africa, 1891
record of for '37, 1010
Hungarian public water supplies, 1417
Hypochlorite solution; factors in germicidal efficiency of, 846
stability of, 367

Ice jam control in large rivers, 717
Indianapolis rate case, 362
Industrial waters; 166
Canadian, 168, 1731
Infiltration works in France, 1431
Inhibitors, theory and evaluation, 184
Insects in water works, 1419
Insurance; of water works property, 1573
on electric motors, 1900
Iodine; bearing waters in Russia, 1000
dosage at Kampen, Netherlands, 530
loss in copper pipes, 1428
salt, effective in goiter, 1428
Ion exchange preparation of pure water, 837
Iron; *see also* Manganese
bacteria; 827, 828
in Buenos Aires water, 830
determination; 832
mercaptoacetic acid, by, 832
o-phenanthroline, by, 832
salicylic acid, by, 832
in ground waters, variations of, 1746
manganese, and, in water, 828
rapid test for, 1747

ABSTRACTS

removal; by aeration and sedimentation, 830
oxidation, by, 179
requirements for distribution piping, 1581
solubility, conditions governing, 829
water treatment, use of salts for, 830

Jerusalem water supply system, 1578

Katadyn, *see* Catadyn

Laboratory; kinks, 189
reception of visitors in, 2086
Lake mud organisms, 1420
Lancashire, Eng., water supply, 1416
Laundry water supply, corrosive, 833
Leaching of lime from mortars, 1584
Lead; determination of in minute quantities, 183
in drinking water, 547
poisoning; 182
from water, 1425
liability of water supplies for, 547
responsibility for, 2087
pipe; corrosion, 2097
and copper, corrosion, 2097
for drinking water in France, 834
extruding machine for, Pirelli, 387
mechanical properties of, 2096
reagent, Dithizone, 188
Leak; *see also* Waste
location; apparatus for, 1583, 2097
by listening rod, 1583
stopped by clay caulking, 1255
unaccounted for water in Germany, 206
Leavenworth, Kansas, system improvements, 1575
Legal pitfalls, avoiding, 1573
Liability of city for polluted water supply, 2087
Light effects on colored media, 1423
Lima, Ohio, distribution survey, 2098
London, Eng.; Metropol. Water Board, '36 report, 534
supply from lower greensand, 552
Los Angeles, Calif.; employees retirement plan, 1569
maintenance trucks, 2096
reservoir repairs, 202
storage at record peak, 1413
submarine pipe, 705
Louisville, Ky., meter practice, 2095
Ludwigshaven treatment plant, 997
Lynn, Mass., water works shop practices, 545

Madison, Wis.; billing procedure, 541
water works, 1729
Madras, India, '36 report of water analyst, 360
Magnesium; *see also* Calcium
determination; 840, 1737
in limestone, 840
palmitate method for, 1737
Magno filters; discussion of, 2105
for phosphate and hardness removal, 2105
in Netherlands, 529
process treatment, 1003
Main extensions, financing in Hartford, Conn., 2084
Manganese; *see also* Iron
determination colorimetrically, 832
precipitation by iron bacteria, 828
Manila, P. I., water supply, 700
Marble filters in Netherlands, 530
Marcus Hook plant of the American Viscose Corp., 175
Marshall dam failure, 1909
Marshalltown, Iowa, water works, 1575
Maryland State Dept. of Health; '36 annual report, 361
'37 annual report, 1413
Mead lake stratification, 554
Meteorological conditions during floods, 376
Meter, water; *see also* Metering
box cover, locking, 1588
connection, insulated, 1588
design and materials, 2095
flow, "rotameter" type, 1011
lubrication, of register, 1587
master, 387
rates and rentals, *see* Rates
sizes, 207, 705
standardization, in Germany, 698
testing, by East Bay Utility Dist., 704
Metering; *see also* Meter
Canada, 387, 1587
Hartford, Conn., 2095
Lyon, France, 1584
Minneapolis, Minn., 1587
Methane; *see also* Ground water
explosion prevention at wells, 709
in ground waters, 380, 1432
Mexico City proposed water works improvements, 700
Metropolitan joint tests, 705
Military water supplies, 1001
Milwaukee gastro-enteritis epidemic, 1003
Mine sealing in Maryland, 1240
Mississippi, survey of water supplies, 1414

Molybdenum company's water supply, 537
Municipal government's faults, 2084

Nantes, France, three storied reservoir, 206
Nashville, Tenn., service arrangements outside city, 1732
Needham, Mass., ground water supply, 711
Netherlands; Groningen provincial water supply, 354
north, provincial water supply, 537
water supplies of, 536, 696
Network flow analysis simplified, 1010
New Bedford, Mass., water board, '36 report, 191
New England droughts and floods, 375
New Hampshire water resources board, 1019
New Jersey ground waters at Parlin, a report, 1431
New Jersey stream pollution study, 1008
New Orleans, record rainfall, 375
New York City; additional water supply, 538
Delaware supply, progress, 1909
water tunnel bids, 201
Nitrite interference with bactericidal action of chlorine, 845
Nitrogen; in water, determination, 839
of lake mud, its influence, 995
Noise in pipes, prevention, 208, 551, 1900
Nomograph for calculations, 1013
Northborough, Mass., treatment plant, 370
North Dakota; ground water lowering, 551
rural water supplies, 2085
Nova Scotia water supplies, 192

Ohio; Dept. of Health, annual report, '36, 532
River, pollution problems, 532
Ontario, Can.; *see also* Canadian
chlorination practice, 180
sanitation progress, 531
water and sewage works construction, 1416
water supply characteristics, 1000
Open channels with adverse slope, 373
Operators qualifications in different states, 1412
Orange Co., Calif., flood control, 1431
Orifice; and pipe coefficients with boiling water, 1013
easily constructed, 1916
submerged, coefficients, 373
Oswestry (Liverpool) booster plant, 205
Ottawa overseas pipe line, 706
Oxygen; determination in gases and liquids, 839
dissolved; determination of, 1735
colorimetric determination of, 838
recorder, 1735
Ozone; determination, 188
use in Stockholm, 697
Ozonization of water, 180

Painting; *see also* Coatings
and paint, 1751
for protection, 177
preparation of surface for, 177
Palmitate determination of magnesia, modification, 1737
Panama City, Fla., new supply, 2106
Paper; food containers; microbial flora of, 2089
suitable, 2089
mill water purification requirements, 168
Paracoli group, study of, 844
Parker dam excavations, 556
Pasadena, Calif.; annual report, '36-'37, 189, 701
shop devices, at, 708
Pension, *see* Retirement
Permutite, *see* Zeolite
pH; explained, 1736
measurement by photo-electric method, 1736
standards, need for, 526
Phenol; coefficient limitations, 841
determination of traces in water, 187
Phoenix, Ariz., domestic air conditioning, 702
Phosphate determination, 184
Phosphorous determination by photo-electric colorimeter, 183
Pipe; *see also* Cast iron, Coatings, Concrete, Distribution, Main, Submarine, Transite, Welding
cleaning device, 1912
coatings, 1245
flow in; coefficients with boiling water, 1013
reduction with age, 374

ABSTRACTS

jointing materials; Sinterit, 1249
sulfur, bacterial disintegration of, 386
material, new German, 1252
reclamation and cement lining, 1912
sizes, economic, for distribution, 382, 1011
spans, record length, 1250
steel; for water mains, 1580
eighteen foot at Outardes Falls, 1251
Toronto, 706, 1250, 1579
wood stave; 201
intake, 1250
leakage, 543
world's largest, 1251
Plankton; decomposition, 995
of Marl lake, 993
Planning; and water sanitation, 539
and water supply in England, 1573
Plumbing; *see also* Air valves, Back-siphonage, Cross connections, Drinking fountains
cross connections, 365, 720, 2093
hazards; in Connecticut, 2094
in Federal buildings, 719
noise in, preventing, 208, 551, 1900
regulation by New Hampshire, 2094
Pollution; *see also* Stream, name of stream
Indiana, ordered to cease, 533
Limmat River, 171
Ohio basin problems, 532
water works safeguards from, 2091
Population determination, intercensal, 1574
Portland, Me., protection of watershed, 1007
Princeton, Ind., treatment, 2107
Public health act of '36 (British), 196
Public relations; *see also* Customer and the laboratory, 2086
improvement of, 2086
Puerto Rican; typhoid fever, 2092
water supplies, 1415
Pumps; Colorado R. aqueduct, for, 1263
Detroit Springwells station, 206
for pumping concrete, 1017
graphical depiction of operations, 550
impellers built up by welding, 1899
new type; 550
the Keelavite, 550
station of West Cheshire Water Board, Eng., 549
testing by models, 1898
turbine driven, in Darmstadt, 1264
water power driven, 550
Purification; *see also* Treatment
economics of, 2102

Quabbin dam and aqueduct, surface and sub-surface investigations, 200
Quebec water works construction, 1416

Railway; water sanitation regulations, 534
water service, material classification for, 541
Rainfall; *see also* Hydrology
and run-off records in England, 377
and stream flow studies in England, 1008
determination; discussion, 714
over an area, 713
forecasts by seasonal distribution, 378
salt content of, 999
Rand, S. Africa, annual report, '37, 190
Raritan river cleanup, 172
Rates; *see also* Sewer rentals
basis for, new, by U. S. Court decision, 362
Canadian, 854, 854, 1733, 1733, 1733
fixing, 1733, 2085
flat, 1733
building, 1733
sprinkling, 1733
metered, 854, 854
outside the city, 363, 1732
return of 6% held sufficient, 854
Red water remedy at Winder, Ga., 2107
Rehabilitation of old water systems, 193
Reservoir; *see also* Concrete, Dam, Tank
bird protection for, 709
concrete; Nantes, France, 3 story, 1913
Oakland, Md., low cost, 2099
San Francisco, Calif., 2099
Vienna, 206
foundation at Cassis, France, 2100
silting of, 196
subterranean, 1583
valve replacement in, 1749
Retirement employees; Los Angeles plan, 1569
municipal system, suggested, 1411
Riga, new ground water supply, 203
River; *see also* Flood, Hydrology, Stream
control and flood prevention, 378

development statute, 533
flow data reviewed, 1890
Roadside water supplies in Ohio, 182
Run-off; *see also* Hydrology
chart for culverts, 715
vagaries of, 1890
Russian bulletin on exchange of hydrotechnical research results, 213

St. Louis, Mo. water dept. annual report, 700
Salem and Beverly filtration plant, 369
Salt Lake City; approves Provo plans, 538
new supply project for, 1732
Salt solution measurement of water flow, 1012
Sand expansion measurement, 2100
San Francisco exposition water supply, 383
Scale formation below boiling point, 1748
Schistocome cercariae removal, 1590
Scout jamboree water supply, 537
Sea water distillation, 193
Seattle dam design, 198
Sedimentation; *see also* Clarification
inquiescent and turbulent basins, 212
rate of, flocculated particles, 1001
Seepage from dams, testing, 1016
Selenium; as a health hazard, 836, 836
detection of, 836
Seminoe dam progress, 556
Sewer rentals, laws and practices, 1734
Shanghai Waterworks Co.; annual report, '36, 699
annual report, '37, 1728
Shasta dam plans changed, 1015
Shop devices at Pasadena, 708
Sieving analyses, precise method, 1002
Silica; determination of, 372
gel medium, 845
scale prevention, 1261
Silver; *see also* Catadyn
determination by the Catadyn process, 187
nitrate solution standardization, 841
oligodynamic action of, 368
Sinterit for jointing, 1249
Sioux City, Iowa, water works improvement, 2100
Sluice gate model tests, 211
Sodium; and alkali metals, determination of, 372
silicate in hot water systems, 1263
sulfate, solubility equilibria of, 371
sulfite decomposition at high temperatures, 1260
thiosulfate, stability of, 841
Softening; *see also* Hardness
and iron removal; at Bicknell, Ind., 829
small plants, 1744
attractions of, 1745
dairy industry, for, 528
German conditions affecting, 178
history and development of, 1745
plants; automatic, at West Cheshire, Eng., 178
design of, 1744
U. S. and Canadian, 529
Soil; *see also* Corrosion, Dams
composition related to angle of repose, 1909
corrosion; determination, 1244
of metals and alloys, 1244
mechanics, 1015
moisture determination, 197
particle size determination by hydrometer, 197
Spillway; *see also* Dams
Keystone dam model, 1014
siphon, 1906
washed out in Louisiana, 198
Spokane; hydro-power pumped well supply, 203
river, pollution studies, 1239
Springfield, Ill., meter practice, 1587
Springfield, Mo., epidemic litigation, 196
Standpipe, *see* Tank
Staves, leakage between, 543
Steam; *see also* Boiler, Pumps
contamination, 547
salt content of, 1261
Sterilization; *see also* Chlorination, Silver
by hot soda solution, 1423
by steam in the laboratory, 1423
of water in the French colonies, 368
Stream; *see also* Hydrology, River
gaging progress in U. S., 1010
pollution; industrial view of, 1240
liability of cities for, 168
surveys, conduct of, 1238
Submarine pipe; *see also* Metropolitan joints
Augusta, Me., river crossing, 1580
intake, wood stave, 1250
Los Angeles, Calif., 705
New York City, 543
pipe, flexible, for, 543
transite, 553
Subsidence of land in California, 200

ABSTRACTS

Sulfite wastes, influence and treatment, 171
Sulfuric acid determination, 839
Swedish municipal supplies, 191
Swimming pool; Cairo, Ill., 852
Earl's Court Bldg., England, 367
survey in Connecticut, 182
Swiss water supplies, 1417
Syracuse, N. Y. maintenance methods, 1913

Tank; *see also* Concrete, Reservoir, Welding
adjustable for subsidence, in England, 1254
cold weather preparation of, 1911
elevated, earthquake resistance of, 1253
failure at Yonkers, N. Y., 207
for high buildings, 542
steel, moving of, 542
wood; settlement causing leakage of, 1254
leakage, 543
Tapping machine, improved, 708
Tarred roads as pollution source, 1008
Tartaric acid for sterilization, 847
Taste and odor control, 995, 996
Teck, Ont., water supplies, 1577
Telemeter, automatic, for gage readings, 1011
Thermal stratification in lakes, 994
Tientsin; British municipal council, report for '36, 190
water supply, 536
Tin determination in alloys, 1739
Titanium salts in water purification, 366
Toronto welded steel pipe line, 706, 1250, 1579
Trains, quality of drinking water on, 853
Transite pipe; *see also* Pipe
C. & N. W. Ry. line, 544
experiences with, 384, 385, 544
river crossing, 544
Underwriters' tests of, 385
wells and screens, for, 553
Transport of dissolved material by liquids, 212
Treatment; *see also* Purification
calculations, graphical, 188
developments reviewed; 527, 998
in '37, 365, 998
Dhibban, Iraq, at, 2108
military water supplies, of, 1001
polluted well water, of, 2103
railroads, value of for, 528
soft humic water, of, 2109
Switzerland, in, 368
Truck, service and maintenance; Indianapolis, 207
Los Angeles, 2096
Tuberculation in Buenos Aires, 1750
Tularemia transmission by water, 853
Turbidity indication by electric eye, 531
Typhoid; *see also* Disease
carriers, treatment of, 2090
dog, infection from, 853
England, prevalence in, 1005
France, prevalence in, 2092
incubation period of, 1005
Indiana, water-borne, 1424
Minneapolis, epidemic, 1003
Puerto Rico, in, 2092
water-borne, 1241
Wisconsin, in, 2090

Value of water works, relative, 1734
Valve; and hydrant locations with dual mains, 1581
discharge coefficients, 1915
location records, 386
seat, protection from scoring, 2098
Vanadium poisoning in rats, 1427
Vancouver, Wash., water works improvements, 1576
Vegetables, effect of calcium in cooking, 1007
Vicksburg, Miss., mixing basin, 530
Vienna, new concrete reservoir, 206
Virgin Islands sea water system for sanitation, 193
Voges-Proskauer reaction studies, 1592
Volumes of cylinder intersections, 374
Volumetric determinations in water analysis, 187

Wales water works practice, 1416
Waste; *see also* Leak
and leakage prevention, 1582
unaccounted for water in Germany, 206
Water; analysis, notes on, 1737
freezing and supercooling of, 1912
hammer; *see also* Noise in pipe
in compound or branched pipe, 1913, 1915
microchemical examination of, 186
pollution research Board, '37 report, 2110
pure, prepared by ion exchange, 837
quality standards and examination, 1000
rights; Colorado and New Mexico, 1415

U. S., claimed by, 1019
Resources Committee's six yr. plan, 1020
-shed control, 533
supply; and planning, British, 539
desert, in the, 1418
engineering, reviewed in England, 695
questions, British, 1572
safeguards to purity of, 2090
theft, 1588
unaccounted for, in Germany, 206
works; construction reviewed in England, 695
design features, 1002
employees, *see* Operators, Retirement
responsibilities, 1570, 1572
Weir crest lengths classify discharge, 211
Welding; *see also* Pipe, Tank
advances in, 201
cast iron pipe, 384
gas fatalities, 852
pipe; 200, 201, 384
at Toronto, 706, 1250, 1579
tank at Kingston, N. Y., 1253
Wells; *see also* Ground water
development by shooting, 553
gravel; construction, 1429
packed, in Mass., 711
pollution, protection from, 203
pumps, 1430, *see also* Pumps
radial, at Canton, Ohio, 381
safe construction of, 553
salt water leaks in, locating, 380
sand, in fine, at Amarillo, Tex., 204
screen; materials, 1429
"Remanit 1800M", for, 1429
shallow, design of, 1897
supply, new, for Riga, 203
worms, removal of, 1419
yield formulas, 709, 1429
Windshield wiper for observation well, 370
Windsor, Ont., water works, 1576
Woburn, Mass., additional well supplies, 712
World's Fair (N. Y.) water supply system, 383, 543

Yonkers, N. Y. water tower fails, 207

Zeolite; *see also* Base exchange, Softening
hydrogen; experience with, 1745
for boiler feed water, 1257
new, for sodium removal, 527
synthetic, manufacture of, 837

INDEX OF ABSTRACT TOPIC HEADINGS

Accounting, 540, *see also* Finance, Rates
Administration, personnel and public relations, 194, 1411, 1569, 2086
Algae, *see* Microbiology

Bacteriological, 842, 1421, 1588, *see also* Chemical, Laboratory methods and equipment, Treatment
Boiler feed water, 172, 1261, 1900, *see also* Corrosion control, Pumping, Steam generation

Chemical, 182, 370, 526, 837, 1735, *see also* Bacteriological, Laboratory methods and equipment, Treatment
Chlorination, *see* Sterilization
Coagulation, *see* Filtration, Treatment
Coatings and paint, 1750, *see also* Corrosion, Distribution
Concrete, 202, 1013, *see also* Dams
Copper, 833, *see also* Chemical, Distribution—meters and services, Health and hygiene
Corrosion and its control, 175, 545, 849, 1243, 1261, 1747, 1750, 1900, *see also* Distribution, Treatment
Cross connection control, 364, 719, 2093, *see also* Health and hygiene

Dams, 197, 379, 554, 1013, 1902, *see also* Concrete, Impounding reservoirs
Distribution—mains, valves, tanks, reservoirs, 206, 382, 542, 705, 1247, 1253, 1579, 1911, 2097, *see also* Impounding reservoirs, Tunnels and aqueducts
Distribution—meters and services, 207, 387, 545, 704, 833, 1584, 2095, *see also* Corrosion control

Employees, *see* Administration, personnel and public relations
Epidemic, *see* Health and hygiene

Filtration, 369, 848, 1001, 2100, *see also* Treatment—general
Finance, 540, 1733, 2083, *see also* Administration, Accounting, Rates

ABSTRACTS

Fire service, 542, *see also* Cross connection control, Rates
Floods and flood control, *see* Hydrology
Fluorine, 834, *see also* Chemical, Health and hygiene, Treatment
Foreign water works, *see* Water supply—general

Gastro-enteritis, *see* Health and hygiene
Ground water, *see* Wells and ground water

Health and hygiene, 181, 363, 834, 852, 1003, 1240, 1424, 2087, *see also* Cross connection control
Hydrants, *see* Distribution—mains, valves and services
Hydraulics—hydraulic engineering, 211, 373, 715, 1010, 1752, 1913, *see also* Hydrology
Hydrology, floods and flood control, 375, 713, 1008, 1889, *see also* Hydraulics
Hygiene, *see* Health and hygiene

Impounding reservoirs, 196, 993, 1007
Industrial water supply, 166
Iron removal, *see* Softening and iron removal

Laboratory methods and equipment, 185, 373, *see also* Chemical
Lead, 833, *see also* Chemical, Distribution—meters and services, Health and hygiene
Limnology, 993, *see also* Impounding reservoirs, Microbiology, Taste and Odor control, Treatment

Mains, *see* Distribution
Manganese, *see* Softening and iron removal
Meters, *see* Distribution—meters and services
Microbiology, 1418, *see also* Impounding reservoirs, Limnology, Taste and odor control, Treatment

Odor control, *see* Taste and odor control

Personnel, *see* Administration, personnel and public relations
Pipe, *see* Distribution
Plumbing hazards, *see* Cross connection control
Pollution, *see* Sanitation and stream pollution
Public health, *see* Health and hygiene
Public relations, *see* Administration, personnel and public relations
Pumping, 205, 549, 1263, 1898, *see also* Steam generation, Wells and ground water

Rainfall, *see* Hydrology
Rates, 362, 854, 1733, *see also* Accounting, Finance
Reports of water departments, *see* Water supply—general
Reservoirs, *see* Distribution reservoirs, Impounding reservoirs

Sanitation and stream pollution, 168, 531, 1007, 1238, *see also* Cross connection control, Health and hygiene
Selenium, 834, *see also* Chemical, Health and hygiene
Services, *see* Distribution—meters and services
Sewage, *see* Sanitation and stream pollution, Treatment
Softening and iron removal, 178, 827, 1744, *see also* Treatment—general
Steam generation, 547, 1255, 1261, 1900, *see also* Boiler feed water, Corrosion control, Pumping
Sterilization, 179, 367, 845, 1592, 1742, *see also* Treatment—general
Stream pollution, *see* Sanitation and stream pollution

Tanks, *see* Distribution reservoirs
Taste and odor control, 995, *see also* Impounding reservoirs, Limnology, Microbiology, Treatment
Treatment—general, 365, 527, 997, 2102, *see also* Filtration, Softening and iron removal, Sterilization, Taste and odor control
Tunnels and aqueducts, 200, 1909, *see also* Concrete, Distribution mains
Typhoid, *see* Health and hygiene

Valves, *see* Distribution—mains, valves and reservoirs

Water quality, *see* Treatment
Water supply—general, 189, 354, 534, 695, 700, 1019, 1413, 1416, 1574, 1728
Wells and ground water, 203, 380, 551, 709, 1429, 1891, *see also* Pumping

ABSTRACTED ARTICLES

AUTHORS

ABBETT, R., 211
ACREE, S. F., 526
ADDISON, H., 1012
ADLER, H., 835
ALDRICH, E. H., 382, 1247
ALLEN, R. W., 1898
ALLIN, R. L., 1906
ALOMIA, A., 700
ANDERSON, S. T., 1587
ANGUS, R. W., 1913
ANTHONY, S. S., 1580
ANTONOFF, N. I., 853
APPLEBAUM, S. B., 527
ARCHAMBAULT, J., 1007
ARCHER, E. T., 204
ARMSTRONG, R. W., 1909
ARNOLD, A. L., 1416
ARTUS, 182
ATKINSON, A., 1749
AUGER, F. H., 205
AUSTERWEIL, G., 837

BABBITT, H. E., 707, 998
BABECKI, W. J., 1001
BABKO, A. K., 188
BAESE, E., 2094
BAGNOLI, U., 837
BAKER, C. P., 1916
BALL, A. S., 207
BALL, C. F., 1017
BALLOU, A. F., 1581
BAMBACH, R., 1264
BANKS, A. L., 1746
BARBER, C. R., 1729
BARBER, E. G., 1748
BARDWELL, R. C., 1900
BARKSDALE, H. C., 1431
BARNARD, T. W., 363
BAROUDI, S., 1418
BAUER, E. E., 197
BAUMANN, P., 1902
BECKWITH, T. D., 386
BEGER, H., 827, 828, 1419
BEHR, J., 1417
BEHRMAN, A. S., 168, 2104
BEIJ, K. H., 1753
BELL, H. K., 2101
BENDFELDT, H., 1902
BENGOLEA, D. J., 1736
BERK, A. A., 371, 1901
BERNARD, M. M., 377
BERRAZ, G., 187
BERRY, A. E., 531, 1416
BEST, W. H., 2087
BILHAM, E. G., 377, 1008
BIRD, F. L., 2083, 2083
BLAISDELL, F. W., 211
BLAKELY, G. W., 544
BLAUM, R., 193
BLÖCHLIGER, G., 171
BLOMQUIST, H. F., 1252
BOGERT, C. L., 1011
BORUFF, C. S., 367
BOTTOMLEY, W. T., 1013
BOVARD, P. F., 386
BOWEN, O. A., 1898
BOWERS, N. A., 1009
BOWLBY, J. L., 548
BOYD, G. E., 849
BRADBURY, T. A., 1257
BRAMBEL, C. E., 183
BRENNER, A., 1750
BRIGHAM, H. L., 385
BRINER, E., 188
BRISTAIN, P., 1915
BRISTOL, T. L., 1733
BROWNE, F. G., 1577
BROWNE, T. P., 1001
BRUNNER, R. W., 172
BRUNS, H., 180, 367, 1240, 1425, 2089
BUCHANAN, J. E., 1255
BÜCHE, W., 849
BUCHER, C. J., 1423
BUDENBENDER, E., 2106
BUICE, W. A., 1239
BULMER, F. M. R., 1428
BUNKER, H. J., 177
BURTON, M. T., 1244
BUSWELL, A. M., 366, 367
BUTLER, A. D., 1239
BUZZELL, D. A., 1014
BYERS, H. R., 375, 376
BYRAM, A. T., 1000

CALDWELL, E. L., 710, 1892, 1893, 1894
CALEY, E. R., 370
CAMERON, A. E., 373
CAMP, T. R., 382

CARMAN, P. C., 2100
CARRIÈRE, J. C., 530
CASALE, D. I., 1751, 1912
CASEY, T. I., 704
CASPERSEN, J., 853
CASSELMAN, W. H., 1009
CATALDI, M. S., 830
CATHCART, A. B., 552
CHARLTON, D., 1594
CHASE, E. S., 2102
CHATTERS, C. H., 2084
CHRISTEN, G., 187
CHUÍKO, V. T., 186
CHULKOV, J., 1594
CHURCHILL, H. V., 836
CLARK, F. W. G., 190, 536
CLAUSSEN, G. E., 1245
CLINE, A. C., 195
CLINE, J. E., 1743
COCHRANE, V. H., 377
COLEBROOK, C. F., 374
COLEMAN, J. O. R., 387
COLEMAN, S. H., 1420
COLLINS, W. D., 166
CONKLING, H., 204
CONNOLLY, J. I., 1004
CONSOER, A. W., 540
COOK, L. H., 531
COOK, P. D., 2100
COOPER, L. H. N., 829
CORNISH, R. J., 373
COSENS, E. J., 1251
COSTEANU, N. D., 184
COGHLAN, R. E., 1901
COULSON, D. C., 1016
COUSENS, E. J., 201
COWLES, M. W., 365
COWLES, R. P., 183
CRAVER, A. F., 177
CRAYA, A., 1914
CRECELIUS, H. G., 843, 1592
CROCKETT, C. L., 1900
CROHURST, H. R., 532
CURRY, J. M., 2087
CYR, R., 1004, 1416

DAGUIN, F., 534
DALLDORF, H., 206
DANEL, P. F., 1914
DANIEL, E. P., 1427
DARROW, H. D., 1253
DAUGHERTY, R. L., 1263
DAUGHERTY, T. H., 1735
DAVIS, A. F., 201
DAVIS, C. C., 196
DAVIS, D. E., 2099
DEAN, H. T., 834
DEAN, J. B., 700
DEBERARD, W. W., 359, 702, 703, 1587, 1729
DECKER, J. M., 1900
DEFILLO, J. B., 2092
DEJUHASZ, K. J., 1914
DENIGÈS, G., 836
DEWELL, H. D., 1254
DEWEY, H., 552
DIÉNERT, F., 547, 834, 1895
DIENERT, M., 536
DIJK, C. P., VAN, 1428
D'ORAZIO, R., 841
DORE, S. M., 200
DORSEY, N. E., 1912
DRAGT, G., 1742
DREYFUS, M. E., 1262
DRYER, W., 1903
DUBREUIL, G., 2092
DUDLEY, H. C., 836
DUNWOODY, J. S., 1729
DWORZAK, R., 372

EAST, L. R., 1904
EATON, H. N., 2093
EBERHARD, E., 1745
EBNER, W., 1583
EDWARDS, A. C., 2090
EGOLF, C. B., 1001
EHRENBURG, D. O., 197
EISNER, B., 543
ELLIKER, P. R., 1590
ELLSWORTH, S. M., 539
ELVOVE, E., 182, 834
EMIGH, W. C., 2086
EMMEL, V. M., 839
ERMOLENKO, N. F., 1902
ESTY, R. W., 207, 1583
ETRILLARD, M., 845
ETRILLARD, P., 185
EVANS, H. E., 1737
EWENS, W. E., 717
EWING, S. P., 175, 176, 1244

FAENDRICH, H., 1581
FAHLQUIST, F. E., 200
FAIR, G. M., 1010, 2110
FEITELSON, B. J., 543
FERRER, J. M., JR., 370
FIEDLER, A., 837
FIELD, H. L., 369
FIELD, J. E., 1903
FINDLAY, W. S., 548
FISCHER, A. W., 1731, 1906
FISCHER, F. P., 2086
FITZGERALD, C., 1245
FLACH, G., 697
FLEMING, D. H., 193
FLOREZ, L., DE, 715
FLORIS, A., 1905
FOOTE, S. D., 378
FORBES, D., 2091
FORBES, G. S., 1743

Fornes, J. G., 545
Fortune, W. B., 832
Foulk, C. W., 548, 1255
Fowler, F. H., 1903
France, R. L., 1422
Frank, C. W., 1734
Frankish, E. R., 1428
Frazière, W. C., 1590
Freze, N. A., 839
Friedrich-Liebenberg, A., 372
Fromherz, H., 368
Fuchss, H., 1425
Fuller, H. U., 195
Fuller, J. E., 1422

Gabriel, A., 371
Gad, G., 838, 1737, 1738, 1742
Galligan, W. E., 1000
Galloway, J. D., 379
Ganapati, S. V., 360
Gangl, J., 186
Garthe, E. C., 853
Gavett, W., 1915
Geisler, 172
Gentner, W. A., 2084
Gevers, T. W., 1897
Ghimicescu, G., 1432
Ghosal, S. C., 1423
Gilbert, R. W., 2107
Gilbertson, W. E., 2085
Gilboy, G., 1015
Gilcreas, F. W., 1245
Giles, J. H. L., 182
Gillman, C. E., 1891
Girand, J., 702
Girard, R., 1584
Glee, G. J., de, 354
Godward, M., 994
Golden, G. E., 2093
Gomez-perez, F., 1904
Gordan, J. G., 1429
Goss, W. H., 526
Goudey, R. F., 993
Grebe, J. J., 716
Green, S. S., 1016
Greene, T. W., 200
Greenwood, D. A., 1000
Greenwood, M., 1005
Gregg, W. R., 1890
Greig, M. M., 1011
Griffith, J. R., 715
Grime, E. M., 1254
Griswold, H. W., 387
Gross, D. D., 1011
Grubitsch, H., 1902
Gubelmann, H., 368
Guillerd, A., 185
Guillot, M., 176
Gumensky, D. B., 202
Guntz, A., 838
Gustafson, H., 2104
Gutmann, I., 380, 1905

Haase, L. W., 178, 997, 1581, 1739, 1748, 2097
Habermehl, C. A., 189
Haering, D. W., 174, 1261
Haines, R. B., 1424
Hajna, A. A., 845, 1591
Hall, G. L., 361, 1240, 1413
Halliday, E. G., 1007
Halpin, H. E., 542
Hamer, P., 174, 1737
Hamer, W. J., 526
Hammond, C., 1262
Hammond, J. W., 835
Haniset, P., 372
Hanley, J. P., 543
Hanna, F. W., 1905
Hannemann, O., 1249
Hansen, A., 838
Hansen, P., 527, 998
Hardy, A. V., 1241
Harford, E. F., 373
Harman, W. C., 543
Harnish, C. P., 850
Harold, C. H. H., 534
Harrington, A. V., 364
Harvey, A. R., 1259
Harza, L. F., 1902
Haseldine, J. F., 1570
Haupt, H., 1425
Hayes, M. W., 375
Hedgepeth, L. L., 1592
Heeney, C. T., 706
Heiss, J., 368
Helland, H. R. F., 542
Henderson, J. L., 1576
Henkel, G. E., 846
Henrici, A. T., 842
Henry, F., 1258
Hernando, E., 700
Hetherington, R. G., 1572
Hettche, H. O., 845
Hewett, A. L., 1583
Hibbs, A. S., 2101
Higgins, R. C., 845
Higham, K. E., 1000
Hinds, J., 1910
Hitchens, A. P., 842
Hoffmann, S., 1594
Holler, 1429
Hoover, C. P., 175
Horning, B. G., 2087
Horowitz, L. J., 2087
Hoskins, J. K., 1238
Hougardy, H., 1429
Houghton, G. U., 187
Houk, I. E., 554
Howard, N. J., 365, 995

HOWARD, P. F., 711
HOWSON, G. W., 1903
HOYT, J. C., 1010, 1889, 1890
HUBER, W. L., 1902
HÜLSMEYER, C., 2098
HUNTER, C. A., 843
HUNTER, R. B., 2093
HUTCHINSON, M. H., 184

IRVIN, R. E., 2102
IVANISSEVICH, L., 530, 1577

JACKSON, P. G., 183
JARVIS, C. S., 1904
JEFFREY, 1745
JENDRASSIK, A., 187
JENNINGS, W. M., 550
JERDEN, A., 191
JEWSON, F. T., 187
JINICH, M., 1904
JOHNSON, M. G., 1245
JOHNSON, R. P., 369
JOHNSTON, E. W., 180
JOHNSTON, H. R., 1015
JOHNSTONE, H. F., 1260
JONES, B., 2096
JONES, E. M., 2100
JONES, M. S., 189, 701
JORDAN, C. F., 2092
JORDAN, D. C., 528
JORDAN, L. A., 177
JORGENSEN, L., 198
JÜRGENSEN, C., 1578

KAESS, A., 698
KAISER, C. T., 192
KAISER, K., 1263
KALINSKE, A. A., 1915
KAPER, L., 1423
KAPUSTINSKAYA, N. F., 1898
KARPOFF, S. P., 853
KEBRICH, L., 839
KELLEY, W. P., 999
KEMPF, C. A., 1000, 1425
KENDALL, T. R., 530, 829, 2106, 2107
KENNEDY, C. C., 704
KILLEFFER, D. H., 841
KIMBALL, O. P., 1428
KIRSCHNER, O., 1012
KITCHING, A. F., 840
KITTRELL, F. W., 1242
KITTO, W. H., 1737
KLEGERMAN, M. H., 1248
KLEIN, G., 835
KLING, A., 1899
KLUT, H., 828
KNAPP, F., 1248, 1904, 1914, 1915
KNAPPEN, T. T., 717
KNIGHT, R. G., 555, 1018
KNORR, 203
KNOWLES, C. R., 1430
KNOX, W. H., 1744
KOBLICE, J., 833
KOCH, B., 1261
KOCHOR, S. J., 840
KOHLER, R., 1909
KOOIJMANS, J., 546
KOOIJMANS, L. H. L., 176, 529
KRAMER, A. J., 356
KRENN, H., 1262
KRENN, J. 834
KROKE, R., 1743
KRUL, W. F. J. M., 696
KRUM, H. J., 2100
KUELLING, 1745
KULA, P., 208
KULJIAN, H. A., 175
KUL'SKIĬ, L. A., 1593
KUZNETSOV, S. I., 995

LAFERRERE, M. H., 1432
LAGRANGE, R., 189
LAJMANOVICH, S., 1750
LAMBERT, 845
LAMBERT, C. F., 1734
LA MER, V. K., 841
LANCEFIELD, S., 167, 168
LANDER, H. N. H., 1571, 2103
LANE, C. L., 384
LARSON, T. E., 185
LAUGHLIN, H., 996
LAURNAGARAY, R., 367
LAW, H., 1252
LAWRENCE, R. E., 1575
LAWRENCE, R. L., 1732
LEEFLANG, K. W. H., 546, 1243
LEFRANC, E., 1895
LEIKIND, M. C., 842
LELIAVSKY, S., 1016
LEVERIN, H. A., 168, 1731
LEVINE, M., 843, 846, 1594
LEWIS, H., 173
LIANDER, H., 184, 1737
LIEBERT, F., 1423
LILLIE, R. D., 1427
LINDSAY, A., 203
LINDSAY, F. K., 835
LIPKOWSKI, DE, 180
LISLE, C. F. J., 718
LIVINGSTON, P., 380
LOCKWOOD, H. C., 1006
LOGAN, K. H., 175, 1749
LOMRY, 1241
LOS, L. I., 368
LOTHIAN, G. F., 1736
LUMB, W. E., 1013
LUMBERT, W. J., 553
LUND, J. W. G., 993
LUNING, F., 2094

LYNCH, W., 380
LYSTER, T. L. B., 1593

MACDONALD, W. E., 194
MACHATTIE, I. J. W., 839
MACHU, W., 184
MACINTIRE, W. H., 835
MACKENZIE, E. F. W., 1242
MACKENZIE, S. H., 705
MACONACHIE, J. E., 839
MAENICKE, R., 852
MAFFITT, M., 386
MALLEY, A. P., 383
MALLOY, F. O., 1911
MALYUSHITS'KIĬ, I. P., 1593
MANSON, A. B., 541
MANTEL, W., 1263
MARATTA, C. M., 381
MARCANO, O., 1415
MARCOVITCH, S., 1006
MARDEN, K., 2087
MARSTON, F. A., 544
MARTIN, H. J., 2096
MASON, M. A., 1914
MASSEY, W. J., 174
MATTHEWS, A. A., 538
MATZKE, A. E., 373
MAURIN, 1899
MAY, R., 1261
MCCABE, W. L., 1001
MCCHESNEY, I. G., 1258
MCCONNEL, S., 550
MCCRADY, M. H., 1421
MCFARLAND, D., 1899
MCGRATH, W. A., 1916
MCKAY, R. D., 192
MCKEEN, W. J., 198
MCMAHON, J. B., 716
MCMILLEN, E. L., 1013
MCNABB, W. M., 840
MCQUEEN, A. W. F., 1251
MCROBERT, G. R., 363
MEADOW, J. R., 1414
MEDLAND, H. M., 1572
MEHLIG, J. P., 832
MELLON, M. G., 832, 1742
MEYER, A. F., 1003
MICHAL, J., 1738
MIDDLETON, S. H. W., 1248
MIGETTE, L., 180
MILBAUER, J., 997
MILLER, A. P., 853
MILLER, C. F., 186, 188, 840
MILLER, L., 172
MINEAR, V. L., 1017
MINNING, W., 845
MISRA, R., 1420
MITCHELL, J., 849
MITCHELL, N. B., 843
MITILINO, G. M., 1593

MOGERMAN, W. D., 1740
MOHAUPT, R., 1574
MOLKE, E. C., 1251
MONYPENNY, J. H. G., 1262
MOORE, E. W., 2110
MORAN, R. F., 1002
MOREHOUSE, W. W., 537
MORRIS, S. B., 1902
MORSE, H. S., 207
MORTON, E., 1897
MORTON, W., 1915
MOULTON, D. E., 1007
MULLER, R., 2105
MULLIN, B. J., 206
MULLINEX, C. D., 2092
MÜNCH, H., 845
MURRAY, R. L., 1593

NAUMANN, E., 997, 1418
NAUMANN, K., 1738, 1742
NAYAR, A. S. M., 363
NELIDAY, I. M., 379
NELSON, V. A., 1000
NELSON, V. E., 1425
NEWSOM, R., 2085
NEWTON, L. O., 173
NOBLE, I., 1007
NOLL, C. A., 1736
NUMACHI, F., 189

O'BRIEN, R. A., 1901
OGDEN, P. H., 1254
OKÁČ, A., 1741
OLSON, W. M., 1002

PAILLAS, P., 368
PALEĬ, S. I., 1740
PALMER, A. E., 1571, 2103
PALMER, H. K., 1247
PANDIT, C. G., 181
PAPP, R., 1417
PAPP, S., 187
PARDOE, W. S., 1253
PARINI, V., 1594
PARKER, L. T., 168, 1573, 2086
PARR, L. W., 710, 1588, 1589, 1892, 1894
PARTRIDGE, E., 371
PATRICK, J. G., 2100
PAULSEN, C. G., 1010
PAVELS, R., 203
PEARCE, C. E., 1905
PEARSON, C. D., 699, 1728
PECKWORTH, H. F., 1902
PELLÉ, A., 182
PELLY, R. G., 187
PERAGALLO, I., 1422
PERINI, P. E., 847
PERROTTET, E., 188
PERRY, C. A., 845, 1591
PETER, A., 997

PETERSEN, A., 1735
PETERSON, O. W., 1902
PETRIK, M., 1897
PFEILSTICKER, K., 997
PHARRIS, C., 1242
PINSET, M., 1431
PIRNIE, M., 830, 1414
PIWOWARSKY, E., 1749
PLOEGER, J., 530
PORGES, N., 995
PORTEOUS, P., 545
POSNER, G. A., 1583
POWELL, S. T., 547, 1258
PRINDLE, G. B., 996
PRÖCKE, O., 1738
PUPIL, F., 1751

RADSPINNER, W. A., 708
RAGHAVACHARI, T. N. S., 181
RAKESTRAW, N. W., 839
RAO, B. S., 1001
RAYMOND, M. R., 993
REBER, L. A., 840
REDDISH, G. F., 841
REED, O., 1902
REED, R. J., 1904
REICHHEIMER, C. E., 1414, 1731
REITH, J. F., 1428
REUSS, A., 185
RHODES, G. I.,177
RICH, A. B. 384
RICHARDSON, C. P., 528
RIGLAR, N. E., 373
RILEY, R., 527
RIVENBURG, M. N., 177
ROBERTS, C. H., 1008
ROBORGH, J. L., 1429
ROCHAIX, A., 1422
RODT, V., 202
RODWELL, J. A., 1582
ROGERS, S. L., 2095
ROGOZÍNSKI, F., 840
ROOS, C. M., 852, 998
ROOS, F. A., 359
ROTHSCHILD, R. B., JR., 2099
ROTHWELL, H. E., 1428
ROUSE, H., 212
ROWE, A. R., 1011
ROWLEY, R. J., 836
RUDD, W. C., 206
RUDOLPH, A. S., 846
RUEHLE, A. E., 842
RUGE, A. C., 1253
RUYS, A. C., 2093

SACK, L. J., 374
SAFAY, F. A., 1430
SAILER, R., 1911
SALAS, N. M., 1738
SANBORN, J. R., 2089
SANGER, F. J., 1904
SARTORIUS, F., 2109
SAVAGE, W., 2088
SAVILLE, C. M.,375, 1890
SAVILLE, F. C., 188
SCATTERGOOD, E. F., 1569
SCHAAFF, F., 997
SCHAPHORST, W. F., 1261
SCHELLENBERG, H., 698, 720
SCHERAGO, M., 844
SHERRER, J. A., 1739, 1740, 1741
SCHIEMENZ, F., 1420
SCHILLING, K., 2105
SCHIOPPA, L., 847
SCHLEY, J. L., 1009
SCHMATOLLA, O., 1747
SCHMIDT, H. M., 717
SCHMIDT, R., 1737
SCHOEPFLE, O. F., 188
SCHOLTZ, W., 1248
SCHONFELDT, N., 697
SCHROEDER, W. C., 371, 1901
SCHUBERT, S., 1745
SCHWEITZER, R. R., 1431
SCOTT, W. J., 833, 1412
SEEBERG, J., 1746
SEIWELL, G. E., 995
SEIWELL, H. R., 995
SERGEANT, F. C. H., 1242
SETINSKI, V., 709
SHAMOVSKIĬ, L. M., 1898
SHANN, T. A., 1584
SHAW, A. L., 2102
SHEEN, R. T., 1736
SHERMAN, C. W., 385, 2099
SHERMAN, L. K., 365, 2094
SHERMAN, W. T., 1411
SHERWOOD, T. K., 184
SHKROB, M., 173
SHORTT, H. E., 181, 363
SHUEY, G. A., 1006
SHVEDOV, V. P., 183, 1739
SIDERIS, C. P., 832
SIGWORTH, E. A., 996
SILFVERSPARRE, W., 171
SIMONDS, A. W., 1017
SIMONSSON, L., 1737
SIMPSON, H. E., 551
SINCLAIR, H., 1264
SITTER, E. A., 174
SKEEN, J. R., 851
SKINNER, H. J., 168
SKROBOV,A. A., 1000
SLADE, J. J., 212
SMALL, L., 705
SMALSHAF, A. J., 2094
SMIRNOV, N. D., 1000
SMITH, E. E., 2098
SMITH, L. A., 541, 553
SMITH, M. I., 836

SMITH, S., 196
SMITH, W. H., 1741
SNOOK, W. P., 2098
SNOW, B. F., 711
SPAFFORD, H. A., 709
SPAULDING, L. H., 1250
SPEAR, W. E., 538
SPENCER, E. Y., 364
SPENCER, W. R., 533
SPLITTGERBER, A., 997, 1735
SPRADLEY, J. W., 1251
SPRARAGEN, W., 1245
STANLEY, C. M., 707
STANLEY, W. W., 1006
STAROSSELETZ, 1594
STAUB, W. S., 1912
STAUD, A. H., 842
STEEL, D. A., 541
STEELE, I. C., 1903
STENE, S., 212
STERN, A. G., 548
STERRETT, E., 995
STEVENS, J. C., 1013
STEVENS, J. S., 704
STEWART, A. D., 1423
STEWART, F. D., 182
STOKES, J. L., 844
STONE, W. S., 1742
STOOF, H., 1739
STOUT, L. E., 1011
STRAUB, F. G., 1257, 1260
STREETER, H. W., 2091
STRICKLAND, G. H., 2109
STRINGFIELD, V. T., 1730
STROHECKER, R., 1747
STROHL, R. M., 1908
STUART, K. E., 1593
SUBBARAMIAH, K., 1001
SUGAWA, Y., 835
SULLIVAN, D. M., 2085
SUTHERLAND, R. A., 379
SUVOROVA, A., 179
SWANK, H. W., 832

TAFF, W. O., 1260
TAJC, J. A., 1259
TANANAEV, N. A., 1740
TANG, N. K., 841
TANNER, F. W., 2089
TANZLER, K. H., 846
TAYLOR, F. J., 1906
TAYLOR, J. R., 2098
TEAKLE, L. J. H., 999
TEIXEIRA, A. S., 838
THISELTON-DYER, G. H., 539, 1573
THOMAS, C. A., 715
THOMAS, D. S., 1574
THOMAS, H. A., 1914
THOMAS, P., 834
THOMPSON, P. W., 1012
THOMPSON, R. O. C., 1417
THOMSON, D. H., 2090
THOMSON, T. C., 174
THURSTON, R. S., 540
THWAITS, E. H., 1580
TIBBETTS, F. H., 1430
TIGER, H. L., 1257
TILLMAN, R., 206
TIMANUS, C. S., 2101
TITTSLER, R. P., 844
TOBEY, J. A., 182
TOMLINSON, H. M., 841
TOPLEY, W. W. C., 1005
TRAUTE, R., 211
TRELLES, R. A., 1738
TRELLES, R. E., 1007, 1427
TROEDSSON, J., 2109
TUPHOLME, C. H. S., 1261, 1899
TURRE, G. J., 551

ULLYOTT, P., 1420
ULMER, R., 548
ULMER, R. C., 1262, 1900
UPTON, W. V., 366, 367

VAN HORN, A. L., 181
VAN HOVENBERG, H. W., 534
VAN IJSSEL, J. J., 529
VAN NIEVELT, B. F., 537
VAN NORMAN, H. A., 1569
VARÓDI, I., 1432
VELTEN, H. J., 715
VELZ, C. J., 172
VERNON, W. H. J., 546
VIBERT, A., 1432, 1896
VIEUX, G., 1422
VIOLET, A., 2097
VIOLLE, H., 847
VON BERGEN, H. E., 379
VON JETTMAR, H. M., 1419, 1423
VON SCHWARTZ, M., 1263

WADDINGTON, A. H., 853
WADE, J. A., 707
WALKER, O. J., 364
WALKER, W. H., 830
WALLACE, T. C., 995
WARD, R. B., 1907
WARING, F. H., 532
WARNER, J. H., 556
WARREN, L. G., 199
WASCHKAU, A., 186
WASER, E., 171
WATSON, M., 1005
WEAVER, R. H., 844
WEBER, M., JR., 1002
WECKWERTH, F., 1252
WEINER, L. P., 851
WEISER, E., 1417
WEISS, J. E., 843

WENDEROTH, H., 378
WENTWORTH, J. P., 712
WESLEY, 172
WESTFALL, B. B., 836
WESTHAUSER, P., 1578
WESTHUYZEN, J. P. V. D., 1897
WESTON, R. S., 370, 850
WHALEY, W. J., 2107
WHIPPLE, M. C., 851
WHITMAN, N. D., 202
WHITTEMORE, C. R., 201, 1579
WICHERS, C. M., 997
WILEY, G., 1016
WILLARD, H. H., 841
WILLIAMS, W. C., 1242
WILSON, C., 999
WILSON, J., 1005
WILSON, J. H., 1903
WILSON, W. E., 1247
WINGFIELD, B., 526
WINSOR, F. E., 200
WINSOR, H. W., 841
WITENBERG, G., 1590
WOLMAN, A., 361, 1413
WOLPERT, N. N., 545, 1913
WOLTMANN, J. J., 1744
WORMWELL, F., 546
WORTH, R. H., 1891

YARNELL, D. L., 1752
YOFE, J., 1590
YOSHIMURA, S., 994

ZHUROMSKAYA, N. M., 1902
ZSCHOKKE, H., 1263

CHANGES IN MEMBERSHIP

February 1 to 28, 1938

New Members

ADAMS, HOWARD J. Engr., Illinois Water Service Co., 122 N. Walnut Street, Champaign, Ill.

ANGLE, C. F. Supt. Water Purification, Tubize Chatillon Corp., Rome, Ga.

BARBER, W. J. Asst. to Gen. Mgr., Metro. Utilities Dist., Water Dept., Utilities Bldg., Omaha, Neb.

BEATTY, EARL E. Mechanical Engineer, 8186 Livernois Ave., Detroit, Mich.

BIELOT, ARTHUR, JR. San. Chemist, Water Works Park Filtration Plant, Detroit, Mich.

BRENNAN, RALPH F. Chemist & Chief Operator, Munic. Water Treatment Plant, Daytona Beach, Fla.

CLARK, H. C. Supt., Municipal Water Works, Hillsdale, Mich.

CONNOR, C. M. Technical Director, Valley Forge Laboratories, Inc., Balligomingo Road, West Consohocken, Pa.

COWHAM, GLENN W. 123 West 5th Street, Montgomery, Ala.

EGBERT, DONALD C. City Manager, Water Dept., Birmingham, Mich.

FAUST, RAYMOND J. Asst. Engr., Michigan Dept. of Health, Lansing, Mich.

GOLDEN, GEORGE. 30 Gerald Avenue, Highland Park, Ill.

GOTESBORGS VATTENLEDNINGSVERK. P. C. Blidberg, Dir., Goteborg, Sweden (Corp. M.)

HANCOCK, GEO. D. Supt., Yorktown Heights Water Dist., Yorktown Heights, N. Y.

HIRN, W. C. Sanitary Engineer, 532 Michigan Bldg., Detroit, Mich.

HOWE, Max G. Supt. Water & Light, Union, S. C.

JOHNSON, ARTHUR B. Topographic Draftsman, 616½ Parkman Ave., Los Angeles, Calif.

KRIZ, FRANK. Div. Engr., Distribution-Water Div., 1640 So. Kingshighway Blvd., St. Louis, Mo.

LAMPMAN, Edw. B., JR. Sanitary Chemist, 172 So. Algonquin, Detroit, Mich.

LEAD INDUSTRIES ASSOCIATION. 420 Lexington Ave., New York, N. Y. (Assoc. M.)

MALLMAN, WALTER LEROY. Bacteriologist, Michigan State College, Dept. of Bacteriology, East Lansing, Mich.

MARTIN, H. B. Supt., Municipal Commission, Mohawk, N. Y.

MENGEL, CARL W. Director, Public Works & Service, City Hall, Greensboro, N. C.

MCELLHINEY, WM. ALVA. Pres., J. P. Miller Artesian Well Co., 9 South Clinton Street, Chicago, Ill.

MCGOWAN, HUGH, JR. Supt., Pumping Station, 15 McLean St., Freehold, N. J.

MCMORROW, BERNARD J. San. Engr., 1629 North Dayton, Phoenix, Ariz.

MICHAEL, A. C. Asst. Mech. Engr., 8300 W. Warren Ave., Dearborn, Mich.

MILLER, NICHOLAS P. Village Clerk, 1775 Washington Ave., Wilmette, Ill.

MOORE, W. D. Pres., American Cast Iron Pipe Co., Acipco, Birmingham, Ala.

MULLEN, B. J. Chief Plant Engr., Detroit Water Supply, 8300 W. Warren Ave., Dearborn, Mich.

POISSON, A. L. Chairman, Water Division, Tecumseh, Ont., Canada.

POTTS, H. G. 257 Superior Street, Wyandotte, Mich.

PRESTON LIGHT & WATER COMM. 833 King St., Preston, Ont., Canada (Corp. M).

READER, R. C. Filter Operator, Bonita, Calif.

REID, W. M. Supt. Water Supply, P. O. Box 114, Canton, Miss.

RANDALL, WILLIAM THOMAS. Vice-Pres. & Gen. Mgr., Neptune Meters, Ltd., 345 Sorause Ave., Toronto, Ont., Canada.

ROBERTS, E. Fred. E. F. Roberts & Co., Brantford, Ont., Canada.

SHAE, RALPH M., JR. Mfg. Agent & Cons. Engr., 1040 Ins. Co. of N. A. Bldg., Philadelphia, Pa.

(Continued on page 40)

NEWS OF THE FIELD

The new grade of "Affiliate" of the American Water Works Association has been established by vote of the Board of Directors. All members of the Association were advised that this step was contemplated at the time of the general statement to members issued on January 31, 1938.

The action follows a long discussion during which it became understood that there were many men in the water works field whose personal interests could be promoted by giving them at least partial contact with Association activities.

There is no feeling on the part of the Board that full membership in the A. W. W. A. is not worth the while of any water works man. But it has become evident that many men on entering the field of public water supply are not sufficiently informed concerning the services this Association is prepared to render them. In order to introduce them to these services, the grade of "Affiliate" has been established. The dues are set at $4.00 per year. March, June, September and December Journals will be sent to Affiliates. These issues of the Journal will contain material of general interest to men in the smaller communities.

By extending the influence of the Association on behalf of men in the smaller cities, it is expected that the quality of water service and the standing of waterworks men will be improved in every state and province where our members may be found.

The terms of admission to the "Affiliate" grade are as follows:

"An Affiliate shall be any person otherwise qualified for Active Membership who, at the time of application, is not nor previously has been a member of the Association and who, for acceptable reasons, does not wish to become an Active Member.

"No corporation, firm or partnership which otherwise would be entitled to the grades of Associate or Corporate member may hold the grade of Affiliate. No employee of an Associate member may become an Affiliate. No person who is the superintendent, the manager, the chief engineer, the superintendent of filtration, the chief chemist or the superintendent of distribution in a plant having more than 3,000 active services, is eligible for the grade of Affiliate. Under unusual conditions, exception to the above may be made by action of the Executive Committee if the applicant sets forth fully the reasons for the exception when applying for the Affiliate grade.

"Affiliates shall not be entitled to vote upon general association questions, and not eligible to hold office in the Association, nor in any of its

(Continued on page 2)

(Continued from page 1)

Divisions. They shall be eligible to vote upon Section questions and to hold Section offices except those of Chairman, Vice-Chairman, Secretary and/or Treasurer. They shall be entitled to all other rights and privileges of Active Members.

The grade of "Junior Member" of the A. W. W. A. has also been established by Board action. This grade is for a limited term, being confined to students in college and universities or to men less than twenty-five years old.

The terms upon which this grade of membership may be held are:

A Junior Member shall be an employee of a municipal or private waterworks, a civil, mechanical, hydraulic, or sanitary engineer, a chemist, a bacteriologist, a student or any otherwise qualified person engaged or interested in the advancement of knowledge relating to water supplies. At the time of his admission he shall be not less than eighteen years of age. His connection with the Association shall cease when he becomes twenty-five years of age, unless he is regularly enrolled as a student in a university or has previously transferred to the grade of Active Member. Junior Members shall receive the Journal and all privileges of Active membership except holding office and voting.

Have you noticed the badge or seal of the Association? It is used on the registration button for the New Orleans convention. One of our valued members in a recent letter, writes:

"The monogram on this badge depicts a pumping station in the foreground of which is a body of water. This monogram to my mind brings visions of a pump house, an engineer with a pair of greasy overalls, a blacksmith shop on the side and a mill pond, which I do not think reflects the standard of the American Water Works Association.

"I think the American Water Works Association should take such steps that may be necessary to design a monogram that the members will be proud to exhibit on their apparel. This monogram should depict the high standard of performance that is now being obtained by the Water Works Association. The monogram thereupon, to my mind, should be symbolic of Health, Protection, and Development of Mankind."

What do you think? What should a badge contain? Should it be a symbolic and traditional thing or should it be precise and modern? This

(Continued on page 4)

NOTHING TAKES THE PLACE OF

SALT

NOTHING TAKES THE PLACE OF

CAST IRON PIPE

Salt for your table—cast iron pipe for your underground mains—nothing takes their place. Both are basic and indispensable as they have been for centuries. Both are better products today than they were twenty years ago. If you demand proved long life and low maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—with permanently tight joints—then you will agree that nothing takes the place of cast iron pipe. Some materials meet some of these requirements but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

CAST Q IRON

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE

The Standard Material Q for Underground Mains

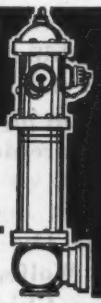
(Continued from page 2)

is an opportunity for our members to do some helpful thinking and produce suggestions that will indicate just what our seal or badge should contain.

For several years there has been a desire on the part of the water treatment plant operators of Illinois, as expressed during the spring and fall conferences on water treatment, that the qualified operators of such water treatment plants receive some evidence of their competency in the form of a license or certificate. At the 1937 fall conference in Springfield a report of the operators' committee on licensing and certification brought out the fact that (1) no law in the State would now allow licensing of waterworks personnel, (2) that the requiring of a certificate of qualification by the State Department of Health does not come under the present authority of that department but that (3) the department can issue certificates of competency to those operators who have such qualifications. Accordingly, the operators requested that this last plan be followed and the issuance of certificates of competency be based upon classification and qualification of operators as prepared by a committee consisting

(Continued on page 8)

FIFTY YEAR
RECORD
of
PERFORMANCE



Complying with
the
SPECIFICATIONS
of the
American Water Works Assn.

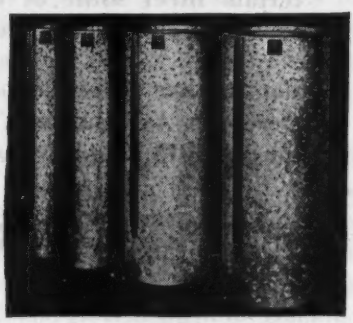
The Kupferle record in the fire hydrant field cannot be ignored. One of the country's very first makers, Kupferle hydrants have an enviable record of more than a half century of dependable performance.

Send for specification sheets—all types and sizes for private and public installations.

JOHN C. KUPFERLE
FOUNDRY CO.
ST. LOUIS, MO.

KUPFERLE
FIRE HYDRANTS

Ford Calibrated
TESTING TANKS



These tanks are made in four sizes. They are heavily galvanized and provided with percentage calibration, gauge glass and quick-opening drain valve. Simple and easy to use. Hundreds in use. Write for information.

The Ford Meter Box Co.
WABASH, INDIANA

APPLICATION FOR MEMBERSHIP
IN THE
AMERICAN WATER WORKS ASSOCIATION
22 East 40th Street, New York, N. Y.

Date:.....

....hereby make application for
(I or We)

.....
(Active, Junior, Corporate or Associate Membership, or Affiliate)

in the American Water Works Association, and enclose herewith the sum of $....., one year's dues in advance.

Name.....

Company or Department.....

Title or Position.....

Address.....

.....

Nature of business or character of work (for office records).....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Signature of Applicant

(over)

ARTICLE I OF BY-LAWS

Section 3. An *Active Member* shall be a superintendent, a manager, an official or employee of a municipal or private water works; a civil, mechanical hydraulic, or sanitary engineer, a chemist, a bacteriologist, or any qualified person engaged or interested in the advancement of knowledge relating to water supplies. (Annual Dues, $10.00.)

Section 4. A *Corporate Member* shall be a Water Board, Water Commission, Water Department, Water Company or Corporation, National, State or District Board of Health, or other body, corporation or organization engaged or interested in water supply work, and shall be entitled to one representative whose name shall appear on the roll of members, and who shall have all the rights and privileges of an Active Member. This representative may be changed at the convenience and pleasure of the Corporate Member on written notice to the Secretary. (Annual Dues, $15.00.)

Section 5. An *Associate Member* shall be either a person, firm or corporation engaged in manufacturing or furnishing supplies for the operation, construction, or maintenance of water works. (Annual Dues, $25.00.)

Section 6. A *Junior Member* shall be an employee of a municipal or private water works; a civil, mechanical, hydraulic, or sanitary engineer, a chemist, a bacteriologist, a student or any otherwise qualified person engaged or interested in the advancement of knowledge relating to water supplies. At the time of his admission he shall be not less than eighteen years of age. His connection with the Association shall cease when he becomes twenty-five years of age, unless he is regularly enrolled as a student in a university or has previously transferred to the grade of Active Member. Junior Members shall receive the Journal and all privileges of Active membership except holding office and voting. (Annual Dues, $5.00.)

Section 7. An *Affiliate* shall be any person otherwise qualified for Active membership who, at the time of application, is not nor previously has been a member of the Association and who, for acceptable reasons, does not wish to become an Active Member.

No corporation, firm or partnership which otherwise would be entitled to the grades of Associate or Corporate member may hold the grade of Affiliate. No employee of an Associate member may become an Affiliate. No person who is the superintendent, manager, the chief engineer, the superintendent of filtration, the chief chemist, or the superintendent of distribution in a plant having more than 3,000 active services, is eligible for the grade of affiliate. Under unusual conditions, exception to the above may be made by action of the Executive Committee if the applicant sets forth fully the reasons for the exception when applying for the Affiliate grade.

Affiliates shall not be entitled to vote upon general association questions, and not eligible to hold office in the Association, nor in any of its Divisions. They shall be eligible to vote upon Section questions and to hold Section offices except those of Chairman, Vice-Chairman, Secretary (and/or Treasurer). They shall be entitled to all other rights and privileges of Active Members. Affiliates receive the March, June, September and December issues of the Journal each year. (Annual Dues, $4.00.)

Memberships will be dated as of the beginning of the quarter in which the application is received.

Membership in the Association carries, also with no additional dues, membership in its Local Sections and National Divisions, and includes the Journal, a monthly publication devoted to water works interest. The proceedings of the annual conventions and of the meetings of the Local Sections are published in the Journal, which also contains contributed articles on subjects pertaining to public water supplies.

Reinstalled

After 60 Years' Service

• Pictured above is a 30-inch diameter *riveted* steel pipe being relaid in Brown's Valley, after 60 years of satisfactory service near Magalia, California.

Other installations of rolled iron and steel pipe possess even longer service records. And remember, in those early days little was known about protective coatings for underground use.

Now with improved coatings and linings, plus wall thicknesses designed for individual conditions, modern Armco *Spiral Welded* Pipe will meet your requirements even more satisfactorily. You also gain increased flow capacity, low leakage loss and freedom from costly breakage. Write for the facts. The American Rolling Mill Company, Pipe Sales Division, 1211 Curtis St., Middletown, Ohio. Branch Offices in All Principal Cities.

ARMCO ARMCO **SPIRAL WELDED PIPE**

(Continued from page 4)

of three operators, a representative of the State Department of Health and a fifth member selected by the other four.

The following classification and qualifications are based upon the work of that advisory committee, which is composed of Fred Roemelin, Superintendent, Hillsboro; Roy Metz, Superintendent, Carthage; John McNicol, Superintendent, Lake Forest; H. E. Babbitt, Professor of Sanitary Engineering, University of Illinois, and C. W. Klassen, Chief Sanitary Engineer, State Department of Health. Obtaining these certificates of competency is entirely optional and voluntary on the part of water treatment plant operators and while these certificates have no legal significance or status they are an indication of the operator's demonstrated ability and qualifications to operate a water treatment plant.

A Class "A" Operator (Minimum Age—21) shall be able to make or supervise the necessary laboratory plant control tests, including physical and chemical, and shall be generally familiar with the laboratory procedure, technique and the interpretation of bacteriological analyses. He shall be informed, in general, on the maintenance and operation of all mechanical equipment and devices in this plant. He shall also be able

(Continued on page 12)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2" to 84"

Flanged Pipe *Flexible Joint Pipe*

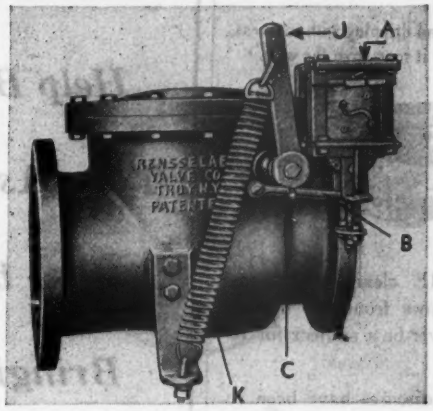
Bell and Spigot Pipe

Special Castings *Short Body B. & S. Specials*

Warren (W) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments



"Something New"

RENSSELAER

Clearway **Quiet-Closing**

CHECK VALVES

Designed to

CUT PUMPING COSTS
ELIMINATE SLAM
REDUCE WEAR ON WORKING PARTS

A swing type Check Valve with Bronze Lifting Cylinder —Lifting Arm—Four-way Valve—Lever Arm—closing spring and a combination holding and releasing solenoid.

Made in two designs. The STRAIGHT-THRU type and the INCREASING TYPE (Inlet one diameter and Discharge a larger diameter.)

Ask for Bulletin "R"

RENSSELAER VALVE CO.

Troy, N. Y.

...*"And dripping with coolness, it rose from the well."**

THE clear, cool water that flows from the modern water faucet may never be a subject for romance, but it *is safe*!

Today, water-borne diseases have been reduced almost to a minimum. The story of this accomplishment with its saving of lives by the millions—is one of the great achievements of the ages.

Eternal vigilance on the part of water-works men and those who supply chemicals for treating water supplies is essential in order to maintain today's accepted high standards of water purification and sanitation methods.

As its contribution to maintaining these high standards, the General Chemical Company supplies water-works and sewage disposal plants with chemicals that are manufactured only under the most rigid control. Its products are unfailingly uniform with respect to chemical and physical composition . . . can *always* be relied upon by water-works and sanitation engineers.

(* *"The Old Oaken Bucket," by Samuel Woodworth*)

GENERAL CHEMICAL COMPANY

Write for information on

Aluminum Sulfate · Ferrous Sulfate · Ferric Chloride · Crystal Alum Ammonium · Crystal Alum Potassium · Copper Sulfate Sodium Metasilicate · Aqua Ammonia · Monosodium Phosphate Sodium Bisulfite, Anhydrous Glauber's Salt, Crystal or Anhydrous · Phosphoric Acid · Trisodium Phosphate · Sodium Hyposulfite · Sodium Silicate · Disodium Phosphate.

GENERAL CHEMICAL COMPANY

Executive Offices:

40 Rector Street **New York, N. Y.**

Sales Offices: Atlanta • Baltimore • Buffalo • Camden (N. J.) • Charlotte (N. C.) • Chicago • Cleveland • Denver • Houston • Los Angeles • Medford (Mass.) • Milwaukee • Minneapolis • Pittsburgh Providence (R. I.) • San Francisco • St. Louis • Utica (N. Y. Wenatchee (Wash.) • Yakima (Wash.)

In Canada: The Nichols Chemical Company, Limited
Montreal • Toronto

Help Build up Your Association by Bringing in a New Member

Application Blank on Pages 5 and 6

American Water Works Association

22 East 40th Street, New York City

DEPENDABLE ALWAYS!

IT takes real skill and scientific knowledge to make a compound like Hydro-Tite. A compound that will make 60-inch joints as easily as 6-inch. A compound that takes up quick—that is always strong, flexible and tight. We believe, and our sales prove, that we alone have such skill and knowledge.

Over 24 Years Without a Failure

HYDRAULIC DEVELOPMENT CORPORATION

Main Sales Office: 50 Church Street, New York, N. Y.
General Offices and Works: West Medford Station, Boston, Mass.

HYDRO-TITE

A DEPENDABLE SELF-CAULKING JOINT COMPOUND

(Continued from page 8)

to be responsible for and to supervise plant operation. He shall have had five years experience in operating the type of plant for which he is making application. He shall have had a grammar school education or its equivalent. Consideration shall be given to reducing the necessary years of experience when the applicant shall have had additional educational qualifications which particularly train him for this type of work. There shall be evidence of the man's active interest in the waterworks profession.

A Class "B" Operator (Minimum Age—21) shall have sufficient knowledge of the laboratory control tests, both chemical and physical, and their interpretation. He shall have a general knowledge of the maintenance and operation of all mechanical equipment and devices in his plant. He shall have had three years experience in the operation of the type of plant for which certification is requested. He shall have had a grammar school education or its equivalent. Consideration shall be given to reducing the necessary years of experience when the applicant shall have had additional educational qualifications which particularly train him for this type of work. There shall be evidence of the man's active interest in the waterworks field.

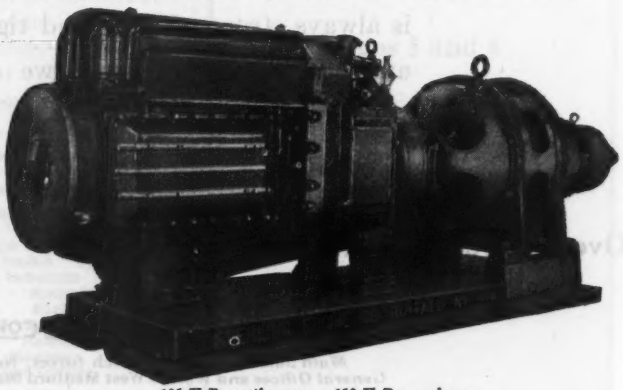
(Continued on page 14)

DIESEL ENGINES ON THE STERLING PRINCIPLE RUN LONGER WITHOUT THE NEED OF SERVICING!

STERLING HIGH DUTY

Sterling

INTERNAL COMBUSTION ENGINES



135 H.P. continuous — 150 H.P. maximum — 1200 R.P.M. continuous service Diesel.

There are no valves to grind; no cylinder heads to crack, or to make cold starting difficult; no crankshaft nor multiplicity of bearings to require attention!

The catalog and recommendations will be mailed you promptly, when you tell us how much power is required.

GAS — GASOLINE — DIESEL — ENGINES

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

STERLING ENGINE COMPANY
Dept. C-3

Branch Office
900 Chrysler Bldg.
New York, N. Y

71 YEARS' EXPERIENCE

And a Wealth of Enthusiasm behind every pound of these

SPECIAL WATER WORKS ALUMS

No single employee, working with you since Andrew Johnson was President, could have accumulated the wealth of knowledge behind every pound of Activated Alum and Black Alum—for all his experience would not have included the benefits of present-day research.

Our staff's experience with treatment of potable waters totals 71 long years ● With us Alum is a Hobby—a Specialty—not just one more chemical in a line ● Our time, experience and facilities go into just one job—making better alum—that works better ● We are not only *manufacturing* specialists, but *Water Works* Specialists, with long and rich experience ● When you deal with us, *your* problems become *our* problems. And, when you order Activated Alum or Black Alum, you get much more than just so many pounds of a specialized chemical.

We'll be glad to send you samples and further information.

"WHEN YOU THINK OF ALUM, THINK OF ACTIVATED"

Activated Alum Corp.

OFFICE: 80 BROAD ST., NEW YORK CITY

WORKS: CURTIS BAY, BALTIMORE, MD.

(Continued from page 12)

The grade of Class "C" Operator (Minimum Age—21) will generally apply to third-shift operators or where chlorination is the only treatment process. He shall have knowledge of the procedure and interpretation of the necessary control tests. He shall have one year's experience in the type of plant for which certification is requested. He shall have had a grammar school education or its equivalent. He shall show evidence of interest in the waterworks field.

There is no requirement that any operator obtain such a certificate. It is purely optional and its purpose is to indicate to those interested whether or not a man is competent to act as an operator of a water treatment plant based upon the qualifications adopted by the department coöperating with the operators advisory committee.

The issuance of these certificates will be a part of the State Health Department's program to promote the efficient and economical operation of water treatment plants, and as in the past, there are no assessments or fees necessary in obtaining such a certificate.

(Continued on page 16)

QUICK SEALING
Bell & Spigot Joints

Tegul-MINERALEAD meets *at once* any reasonable specification as to leakage • Permits immediate backfilling and clean-up of premises • Tougher than other lead substitutes. 3 times more elastic than other sulphur compounds. 20 times more resistant to thermal shock • Ingot form. Easy to store and handle • Requires no skilled labor • Can't change composition in transit

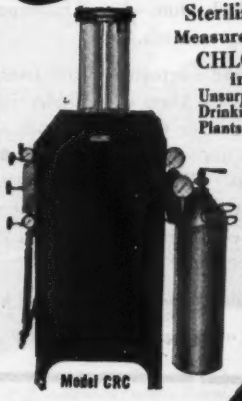
A Tegul PRODUCT

Tegul-MINERALEAD

Write *The* ATLAS MINERAL PRODUCTS *Company of Pa.*, Mertztown, Pa.

Everson

Sterilizing Apparatus
Measures—Mixes—Feeds
CHLORINE GAS
in solution
Unsurpassed for sterilising Drinking Water, Sewerage Plants, Swimming Pools.



A Complete line embodying the new EVERSON Rota-Meter Gas Flow Control that introduces a new degree of Accuracy, Dependability, Ease of Control, Safety and astonishingly low prices.

Capacity ratios of from 1 to 10 between maximum and minimum Finger-tip control. Write for Illustrated Bulletin.

Astonishing NEW EVERSON development of the Rota Relay . . . provides 1 to 30 capacity ratio equipment for applications requiring extremely wide range of gas delivery

EVERSON MFG. CO.
221 W. Huron St., Chicago, U. S. A.

MEET THE "WATER SMELLER"

Water Smeller
He Tests Water by Sense of Smell
This Man Tests Water By Unusual Sense Of Smell
WATER SMELLER STARTS SURVEY
TYRONE CHEMIST HONORED FOR ABILITY
"WATER SMELLER" NAMED FOR CITY
BAD WATER FLAVOR DRIVES GOOD CORN TO DISTRACTION
Water Smeller

This demonstrates the value of publicity created for the purpose of arousing the interest of Mr. John Public in the important functions of water departments.

HENRY LAUGHLIN (Water Smeller) will be on hand at The American Water Works Association Convention at New Orleans. Arrangements for the future can be made at that time to carry out tests in your own laboratory showing the effectiveness of AQUA NUCHAR for taste and odor removal.

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

230 Park Avenue
New York, N. Y.

417 Schofield Bldg.
Cleveland, Ohio

205 W. Wacker Drive
Chicago, Ill.

MANUFACTURERS OF NUCHAR ACTIVATED CARBON

(Continued from page 14)

For a number of years the Underwriters' Laboratories, Inc. of Chicago has been investigating steel pipe as used for underground water service. The investigation has proceeded with the coöperation of nine major companies. Each company manufactures pipe, pipe couplings or plate and each contributed data and information and furnished material and facilities for conducting numerous tests. In addition, the Laboratories made field examinations and summarized answers to a widely circulated service record questionnaire. Total cost of the investigation would approximate $50,000.

A complete 150-page cloth-bound report of the findings has recently been released by the Laboratories and mailed to various municipal and waterworks officials and engineers. It constitutes an important contribution to engineering literature on the subject of steel pipe. The following abstract quoted from the report shows the scope of the work:

"Basic facts will be found in this report relative to the suitability of steel pipe for underground water service . . . Manufacturing processes are described and pictured. Uniformity of chemical properties and physical characteristics are shown by small-size test specimens and also by tests

(Continued on page 20)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

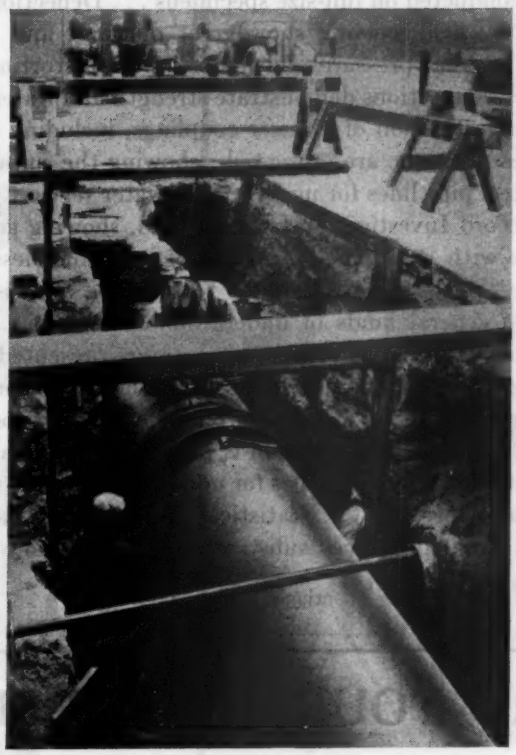
Hand Operated—size 2″, 2½″, 3″, 4″
Power Operated—size 3″ and 4″
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

THE ANSWER TO A PROBLEM

ALCO PIPE FOR CHICAGO



Cities using ALCO STEEL PIPE include the following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W Va.
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y
New Brunswick, N.J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

The Water Department of Chicago and the Chicago Union Station were jointly and seriously concerned about the material to use in the 36" line to replace pipe running under the tracks of the station. The answer, illustrated above, is Alco Electric Welded Steel Pipe. No further need to worry about disastrous breaks.

ALCO FEATURES

Greater Strength
Longer Life
Smoother Waterway
Longer Lengths
Fewer Field Joints
Low Initial Cost
Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS DIVISION

30 Church Street New York, N. Y.

CHICAGO WASHINGTON PITTSBURGH HOUSTON TULSA

Plants at Dunkirk, N. Y., and Montreal, Canada Cable Address: Alproducts.

AMERICAN LOCOMOTIVE COMPANY

(Continued from page 16)

to destruction conducted on full-size specimens . . . Deflection tests of shop lengths joined by field welding show great ductility and freedom from leakage under internal pressure and under severe distortion . . . Tests of threaded service connections demonstrate strength and water tightness . . . Results of an investigation of Dresser couplings, including deflection and hydrostatic pressure tests, are presented—showing the suitability of these couplings for steel pipe lines for underground water service . . . The results of a Service Record Investigation are presented, showing generally favorable experience with steel pipe . . . Tables of wall thickness of steel pipe and correlative information are given—to serve as a basis for selection of pipe for two general kinds of underground service, i.e., transmission mains and distribution mains . . . Recent data are presented on soil corrosion, indicating that in many situations throughout the country it is not necessary to provide special external protective coatings for underground steel pipe lines . . . Useful information is presented regarding internal and external protection of steel pipe lines for underground water service against tuberculation and corrosion . . . Statistical and technical data are offered in the Report and Appendices substantiating the conclusion that steel

(Continued on page 22)

CLEAN YOUR WATER MAINS

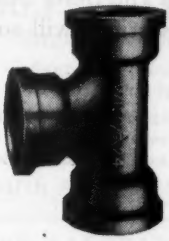
One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

50 Church St., New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.



Don't Take Chances

Everywhere that water stops or changes its course, Grinnell's wide line of Socket Fittings offers a full measure of service and quality.

Grinnell elbows — tees — crosses — clamps—valves of all types, assure you easy, compact installations . . . trouble-free operation.

Conveniently located warehouses make for prompt delivery. Grinnell Co., Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

SOCKET FITTINGS BY

GRINNELL

. . . WHENEVER PIPING IS INVOLVED . . .

(Continued from page 20)

pipe properly designed and installed is reliable as a means of conveying water under ground."

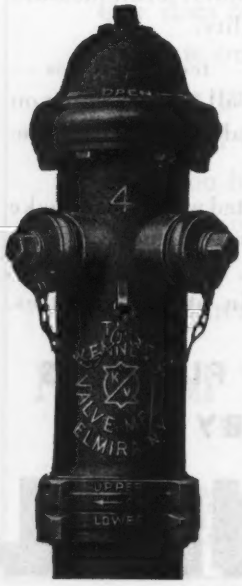
The new Michigan Section of the A. W. W. A. is moving ahead in fine order. The organization meeting at Lansing on February 18th was attended by over 50 men, Earl E. Norman of Kalamazoo was elected chairman and M. N. Gerardy of Detroit, secretary.

Taking their cue from the men of Michigan, members in Ohio and West Virginia have set up organization committees and are moving rapidly to petition for section status. W. R. LaDue of Akron is chairman of the Ohio group and A. R. Todd of Wheeling, chairman of the West Virginia group.

In each state full accord has been established with the State Sanitary Engineer and there is every evidence that two fine sections will soon be moving forward in the Association field.

(Continued on page 26)

Why your community should have SAFETOPS



MINIMUM pressure loss provided by extra large standpipe and smooth easy elbow and nozzle curves.

Maximum reliability assured by simple, straight-line operating mechanism and special long-wearing valve and gasket materials.

Minimum repair expense secured by the unique Safety Breakable Section. When struck by an impact which *no* hydrant could resist, this section parts cleanly, protecting the major and expensive portions of the hydrant from damage. The hydrant can be returned to service by one man, within half an hour, without excavating or shutting off the water pressure, and with parts costing only $6.00.

Maximum convenience obtained by ease of adjustment of working parts, nozzle positions, lubrication, etc.

Write for descriptive bulletin

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY SAFETOP FIRE HYDRANT

REG. U.S. PAT. OFF.

MORRIS KNOWLES, INC.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.
Pittsburgh, Pa.

METCALF & EDDY
Engineers
Charles W. Sherman — John P. Wentworth
Almon L. Fales — Harrison P. Eddy, Jr.
Frank A. Marston — Arthur L. Shaw
E. Sherman Chase
Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories — Valuations
Boston, Mass. Statler Building — **Harrisburg, Pa.** Telegraph Building

REEVES NEWSOM
Engineer - Consultant
Supply, Purification and Distribution of Water
Operation — Design — Construction
Valuation — Rates — Negotiations
Investigations — Taxes — Accounting
500 Fifth Avenue New York City

PEASE LABORATORIES, INC.
39 West 38th Street, New York
Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.
Chemists Field Sanitary Surveys
Bacteriologists Consultants

MALCOLM PIRNIE
Engineer
Water Supply, Treatment, Sewerage,
Reports, Plans, Estimates,
Supervision and Operation
Valuation and Rates.
25 W. 43rd St., New York, N. Y.

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings
50 Church St. New York City

ALEXANDER POTTER
Consulting Engineer
Specialties: Water Supply and Sewerage
50 Church St. New York City
Telephone 5301 Cortlandt

CLYDE POTTS
M. Am. Soc. C. E.
Consulting Sanitary Engineer
30 Church Street - - New York
Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

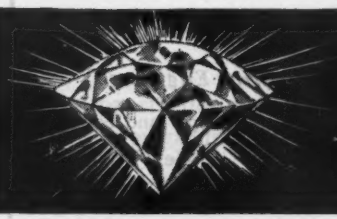
SCOFIELD ENGINEERING CO.
Consulting Engineers
Water, Gas, Electric Plants and Distribution Systems
Appraisals, Valuations and Reports
Design—Supervision—Operation
Philadelphia, Penna.

WESTON & SAMPSON
Robert Spurr Weston — **G. A. Sampson**
Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.
14 Beacon St. Boston, Mass.

Help Build up Your Association by Bringing in a New Member

SEND FOR APPLICATION BLANK

AMERICAN WATER WORKS ASSOCIATION
22 East 40th St.
NEW YORK CITY



CARBON
In Its Highest Form

But Valueless for Water Purification

Although the diamond is carbon in its most valuable form, it is worthless compared to CLIFFCHAR ACTIVATED CARBON for water purification.

Leading municipalities place high value on CLIFFCHAR to remove objectionable taste and odors from water supply.

CLIFFCHAR "R"
Special Grade for Water Purification

Low phenol value, shown by standard phenol tests, gives high ability to remove phenolic and similar compounds.

Extreme fineness (99% passing a 325 mesh screen) gives maximum surface exposure and adsorptive capacity.

Controlled, uniform density assures sufficient suspension period to take full advantage of its high adsorptive ability, yet settle out in ordinary settling basins.

The technical and laboratory facilities of this company are available without obligation to those concerned with taste and odor problems in water purification. Your inquiry is invited.

Cliffs Dow

CLIFFS DOW CHEMICAL COMPANY, Marquette, Michigan
Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Sts., St. Louis; Field Bldg., Chicago

(Continued from page 22)

The National Fire Protection Association will hold its 42nd annual meeting at the Haddon Hall Hotel, Atlantic City, from May 9th to 12th, 1938. Committee reports on hose couplings and nozzles, glass as a material of building construction, public water supplies for private fire protection, automatic sprinklers, tanks and hydrants, dust explosion hazards, and similar matters of interest to water works men will be made.

Do you bind your Journals? Would you like to have them bound according to a standard specification at a special rate? Negotiations are now in progress with a binders' association and give promise of setting up a procedure which will be of material benefit to members of this association. Drop a card to this office if you are interested.

Many cities are putting their water meter inspectors in uniform, according to advices received by the American Water Works Association, national association of water officials and operators. The addition of water employees to the uniformed forces of a municipality is prompted not only

(Continued on page 28)

Any approved and accepted style of connection at the main is embraced in the Mueller line of Corporation Stops. The Mueller thread (CS or CC thread) has been adopted by 90% of all waterworks and is recognized as the A. W. W. A. standard.

PRECISION IN EVERY DETAIL

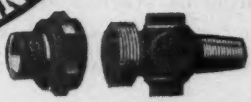
UNIFORM COPPER CONTENT OF 85%

H-10150 Lead Flange Gooseneck. Sizes ½" to 2". Also furnished in 2, 3, 4, 6, 8 branch.

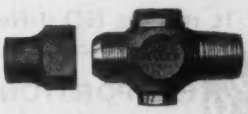
H-10151 Wiped Joint Gooseneck. Sizes ½" to 2" inclusive.

H-10001 Corporation Stop with "Mueller" outlet thread, ½" to 2" inclusive.

Millions of SERVICE YEARS—*your guaranty*



H-10002 Corporation Stop with lead flange couplings, ½" to 2" inclusive.



H-15000 Corporation Stop for use with Mueller Copper Service Pipe, ½" to 2" inclusive.

H-10003 with I. P. outlet thread one size larger than body, ½" to 2" inclusive.

H-10012 with I. P. outlet thread same size as body, ½" to 2" inclusive.

The word "brass" has the same meaning day in and day out at the Mueller plant. It means the ideal mixture, as determined by long experience—a specific structure and strength—an unvarying copper content of 85%. Sample bars are taken from every heat poured by Mueller furnaces — elongation and breaking points are established — grain and fibre are studied.

But this careful control merely starts with the castings. It also follows the product through every stage of production and ends with the final rigid inspection that is your guaranty of Mueller uniformity. While it is true that nothing could be more simple than a Corporation Stop, it is also true that there are few pieces of equipment requiring any greater precision in manufacture.

That is why specially designed machines are used for grinding tapers and polishing the keys into practically no-tolerance fit. Throughout the operations, parts are checked by special gauges. Why accept less than these Corporation Stops that have set the standard of quality for three-quarters of a century?

MUELLER CO., Decatur, Ill.

Factories: Decatur, Ill.; Chattanooga, Tenn.; Los Angeles, Calif.; Sarnia, Ont.

Branches: New York and San Francisco

MUELLER

WATER DISTRIBUTION EQUIPMENT

(Continued from page 26)

to protect householders against intrusion of imposters, but also to save time of the inspectors. Just as a policeman is recognized immediately by his uniform, experience has demonstrated that identification is prompt and often several minutes are saved by a uniformed inspector in gaining admittance to a dwelling.

Blue uniforms with distinctive caps are most popular, although gray has been adopted in some cities. None of the water men's uniforms, however, are the dress parade affairs that characterize policemen and firemen. Instead, the meter readers' costumes are simple and suited for an active life of climbing up and down stairs, and reading meters in basements, often so cluttered as to make the work like a steeple-chase. In place of coats, most of the uniforms have blouses.

In most large cities meter inspectors wear badges, although identifying cards are still relied upon in a few municipalities. The trend towards uniforms started after the adoption by some cities of distinctive caps carrying badges. These caps expedited identification and in many cases led to complete uniforms.

(Continued on page 30)

It makes NO difference to

% PROPORTIONEERS %

7

WHAT YOU PAY

Regardless of price, in its class there's no sturdier, more dependable equipment than %Proportioneers%.

8

WHERE YOU ARE

There's a %PROPORTIONEERS% Agent within reasonable distance—although this is least important, since these simple devices have proved nearly service-free.

SO

It will make a BIG DIFFERENCE in the ease of solving your chemical feeding problems if you write—wire—or phone

% PROPORTIONEERS, Inc. %
18 Codding St., Providence, R. I.

Copies of the Journal for October, 1937 are now out of print. Any member possessing a copy ot this issue which he does not wish to keep should advise this office. We will pay 50¢ each for copies to meet the needs of new members.

IF YOU HAVE A COPY AVAILABLE, JUST DROP US A POST CARD

AMERICAN WATER WORKS ASSOCIATION
22 East 40th St., New York

CRANE
CRANE SLUICE GATES
FOR SEWAGE TREATMENT PLANTS
The nation's health depends on efficient sewage disposal. That's why ordinary equipment will not do in sewage plant service. Sluice gates, for example, must be good through and through—because it's their inside quality that counts most in the rigorous service they must perform.
The goodness of a Crane sluice gate is well assured even before it appears on a blue print—because Crane-Quality means the ultimate development of design and metallurgy in the engineering of water control equipment, combined with a manufacturing background of more than 80 years. Crane-Quality means dependable quality—inside and out.
Crane-Quality is available for every sluice gate and valve requirement in your plant. The Crane line is complete—in range of sizes, types, and operating mechanisms—all of proved quality under severest conditions.
If you haven't received Crane's new book on Water Control Equipment, write for a copy today. It contains a lot of useful engineering data.
Attention—A. W. W. A. Men: Bring your equipment problems to the New Orleans Convention. Crane engineers will be there to help you solve them. April 25 to 29 at the Roosevelt Hotel.
CRANE
VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS
CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVE., CHICAGO, ILLINOIS
NATION-WIDE SERVICE THROUGH 134 BRANCHES AND MORE THAN 500 WHOLESALERS
IT'S WHAT'S INSIDE THAT COUNTS!

(Continued from page 28)

A number of cities are now considering the adoption of uniforms for water employees. Generally no serious objection to the wearing of uniforms is expressed by the workers affected, but in a few instances the proposal has met with opposition that uniforms might lower the morale of the meter readers. It is reported that in one city the workers wanted double-breasted uniform coats with padded shoulders, and gleaming with brass buttons. That suggestion, however, was not adopted.

"Public Health in the World of Tomorrow" is the central theme of the 67th Annual Meeting of the American Public Health Association to be held in Kansas City, Mo., October 25–28.

Recognizing that the responsibilities of the health official have expanded by sheer force of necessity into fields of diagnosis and treatment, considered in the very recent past as beyond the circle of health department obligations, the program of the Association's 67th convention will attempt to look around the corner and see what's ahead for the career man or woman in the public health profession.

It is agreed in Association councils that the advance in public health has been so rapid in the last half dozen years that a clarification of current objectives and policies is urgently needed. The convention will sound that note at the beginning of its deliberations, getting under way with a session devoted to a discussion of the present state of the health of the nation. Thereafter, the central theme, "Public Health in the World of Tomorrow" will be emphasized throughout the several days of meetings. An attendance of 3000 is expected at the Kansas City Annual Meeting drawn from every state in the Union, from Canada, Cuba, Mexico and from abroad.

The Water Leak Detector Company, of 155 North Third Street, Columbus, Ohio, wishes to announce the publication of a new catalog, describing its full line of 1938 "UNIVERSAL" Water Leak Survey equipment, copies of which will be sent upon request.

The Permuit Co. has issued a special bulletin on the "Floc-former" which will be of interest to men engaged in water treatment. Copies may be obtained by writing the Permutit Co. at 330 West 42nd St., New York.

Have you a used air compressor for sale? If so, write Denny and Clark, 910 North Marshfield Ave., Chicago, Illinois. That firm specializes in reconditioning and resale of such equipment and may make it possible for you to dispose of equipment no longer needed at your plant.

(Continued on page 32)

"What do you mean better QUALITY in Trident and Lambert meters? I thought Neptune always was tops in making water meters."

"And still are—only more so. The added quality Neptune is putting into water meters today is finer finish, newer standards of precision, closer tolerances . . . certainly you'll admit that their development of new shop machines and modernized production methods is characteristically another Neptune step-forward in water meter manufacture."

Modern Interchangeable parts in a 39-year old Trident casing

NEPTUNE METER CO.—THOMSON METER CORP.
50 WEST 50th STREET (Rockefeller Center) NEW YORK CITY
NEPTUNE METERS, LTD.
345 SORAUREN AVENUE, TORONTO,
ONTARIO, CANADA

TRIDENT

AND LAMBERT WATER METERS—OVER 6 MILLION

(Continued from page 30)

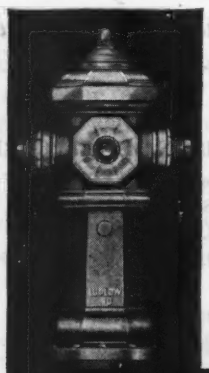
Several hundred cities have built sewage disposal plants during the past few years and the financing of those projects is being carried out largely through increases in the water rates, according to advices received by the American Water Works Association, national association of water officials and operators. The amount of water used is considered a fair measure of what a taxpayer should pay towards the financing and operating expenses. Sewage disposal costs vary, but in some large cities amount to 25 per cent of the water charges. Growing public opinion against the pollution of streams and lakes by discharge into them of raw sewage will result, it is believed, in continued municipal activity in the construction of disposal plants.

In Detroit, Mich., which discharges its sewage into the Detroit River, water rates will carry a sewage disposal surcharge of 20 to 25 per cent after Jan. 1, 1939, to defray the cost of construction and operation of the new municipal disposal plant, according to Laurence G. Lenhardt, superintendent and general manager of the city's Department of Water Supply. The operating costs of the plant are expected to run about $1,200,000 a year.

(Continued on page 34)

Check **LUDLOW** *Hydrants*

Check these points about the Ludlow No. 90 hydrant—



√ Full force—no obstruction in waterway

√ Non-freezing—drains from bottom

√ Surge and water hammer eliminated

√ Replaceable without digging

√ Parts easily removable—low maintenance

—and finally, the most modern, graceful design obtainable. Send for free folder.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

THE LATCHSTRING'S ALWAYS OUT AT

ACIPCO

While you are on your way to the A.W.W.A. Convention in New Orleans, you're cordially invited to stop over in Birmingham on April 23rd and

Witness the Manufacture of

MONO-CAST CENTRIFUGAL PIPE

★ ★ ★

AMERICAN
CAST IRON PIPE CO.
Birmingham, Ala.

NEW YORK CITY · CHICAGO · KANSAS CITY
MINNEAPOLIS · DALLAS · LOS ANGELES
SAN FRANCISCO · PITTSBURGH · CLEVELAND

"UNIVERSAL METHOD" OF WATER LEAK SURVEY

WITH YOUR OWN MEN

SUPER-POWER PANEL

You can eliminate guess work entirely with the "UNIVERSAL" Measured Sound Method. Visual amplitude recording eliminates mistakes caused by the failings of the human ear. And having located the leak, by a simple process its approximate size can be determined in advance of excavation.

You owe it to your city to modernize your water department with "UNIVERSAL" Water Leak Survey instruments. Make your own survey at the minimum of cost to fit your own particular need.

The "UNIVERSAL" Super-Power (Converter type) instrument (shown below) is built to enable the water leak survey engineer to detect VERY SMALL LEAKS at long distances through hydrants and valves, and also to locate these small leaks under the pavement.

We will furnish an experienced instructor upon request to train your men. The time and cost involved may well be repaid within the first week.

This same instrument, with extra attachments, will locate your buried pipe lines.

Demonstrations given upon request and without any obligation.

"UNIVERSAL" COMPLETE WITH PIPE LOCATING ATTACHMENTS

WATER LEAK DETECTOR CO.

155 N. THIRD ST. COLUMBUS, OHIO

BRANCH OFFICES:

142 Ashland Place, Brooklyn, N. Y.
1403 Oliver Building, Pittsburgh, Pa.
419 Smith Tower, Seattle, Wash.
J. Van Benschoten,
58 Pelham Ave.,
Toronto, Ontario, Canada

(Continued from page 34)

The first application for Junior membership in the A. W. W. A. came from William R. Wise, of Clemson College, South Carolina. He describes himself in these words:

"I am a junior in Clemson College, a member of the South Carolina Water Works Assoc., hold an operator's certificate of filter operation in the state of South Carolina, have around four years experience in filter operation, and every week-end I hitch-hike around 200 miles to work every Saturday and Sunday at a filter plant serving a population of 9,000. And by the way, I am 23 years old."

There's something right about that fellow—and incidentally his name is a good one for number one Junior Member. It's a sort of good omen. Gets the Junior membership idea off on the right foot. More power to Wise and all the Juniors.

Development of water facilities in the South to meet the growing demands for expanding population and steadily rising standards of living, as well as to provide for the increased needs of the South's industry, made great strides in 1937.

In the seven states of Alabama, Arkansas, Georgia, Louisiana, Mississippi, Tennessee and Texas 95 water works systems were constructed or their facilities extended last year, the association found. At the beginning of 1938 a total of 73 additional projects were either under way or planned for the current year in the seven states. Similar progress is being made in the other Southern states, although the projects in them have not yet been tabulated.

(Continued on page 36)

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.

Lawrenceburg — Indiana

WELL SCREENS

To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.

2304 Long Avenue, St. Paul, Minn.

SAVE 80% ON YOUR TRENCHING COSTS WITH A

GIANT PIPE PUSHER

10 DIFFERENT SIZES TO FILL EVERY NEED

WRITE FOR CATALOG

Dept. P-3

GIANT MFG. CO.

Council Bluffs, Iowa

POMONA PUMPS

WATER LUBRICATED TURBINE

POMONA PUMP CO.

POMONA CALIFORNIA

LOS ANGELES CHICAGO

PROGRESS

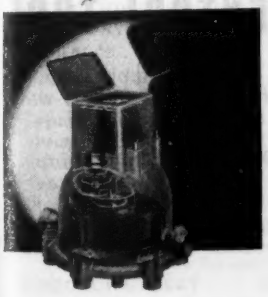
from an idea to an industry

Throughout the years that have seen the greatest progress in water works engineering, the National Meter Company has led in developments which have advanced metering from an experiment to an economic essential . . . developments which have advanced the manufacture of water meters from an idea to an industry.

The National Meter Company was first to introduce the velocity type of meter, first to offer the enclosed intermediate and the straight reading register, and first to develop and perfect frost protection features.

Then, too, both the positive-displacement oscillating piston and the disc-type meter were invented by Dr. L. H. Nash of the National Meter Company . . . meters so simple in design and construction, so accurate and dependable in operation that their basic principles are still used universally and are recognized as outstanding contributions to water works engineering.

The progress and leadership of the National Meter Company will be devoted in the future, as in the past, to the service of the water works industry.



NATIONAL METER COMPANY
4207 First Avenue • Brooklyn, N. Y.
BOSTON • CHICAGO • DALLAS
LOS ANGELES • SAN FRANCISCO

NATIONAL *Meters*

(Continued from page 34)

The South's growing industries are calling for increased supplies of water, which are being met. Some plants, such as textile and paper mills, require millions of gallons of water daily. One large paper mill in West Virginia co-operated with a city in building a larger water system. Many large paper mills have been built in the South during the past few years, and their location has been determined chiefly by the water available in the district. Water is an important factor in the operation of many industries, and cities of the South seeking to attract industries must be able to offer ample, reliable supplies of water at reasonable rates.

The Maryland-Delaware Water and Sewerage Association will hold its annual meeting at Baltimore on May 19th and 20th. The water works improvements now in progress at Baltimore will be described by Leon Small, Water Engineer. Walter Monroe, of the Anne Arundel County Sanitary Commission, will discuss "Rubber Pipe for Special Uses." Other valuable addresses will be given by Abel Wolman, Linn Enslow, L. L. Hedgepeth, A. A. Wood and other men notable in the water supply field.

(Continued on page 38)

50 Years' Supremacy

THE HERSCHEL STANDARD VENTURI TUBE

for Main Pipe Lines

Combining Greatest Accuracy of
Flow Measurement with Lowest
Friction Loss

BUILDERS IRON FOUNDRY VENTURI "VENTURI"—Registered **9 CODDING ST., PROV., R. I.**

STRONG BLACK CIGARS

KEPT THE PLAGUE AWAY

Not so many more than a hundred years ago, men smoked the strongest cigars they could obtain to kill the plague germs that might lodge in their throats.

We know better today. But it was a long time before people of past generations connected their impure water systems with the horrible scourges that periodically wiped out towns and cities.

Liquid Chlorine, "the great purifier," is used almost universally in water systems as the primary means of disease elimination. Water-works officials no longer must be sold on Chlorine's merits.

But state and municipal authorities *must* be assured of quick and adequate supplies of Liquid Chlorine . . . assured of good advice and adequate technical assistance when they need it! The "Big 3" Solvay plant service is a service system upon which water-works men can always depend for supplies and assistance.

Solvay Liquid Chlorine shipments are now routed from Syracuse, New York; Hopewell, Virginia; and Baton Rouge, Louisiana. Your inquiries on Solvay Liquid Chlorine are cordially solicited. Please write to the nearest branch office listed below.

SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 RECTOR STREET NEW YORK, N. Y.

SOLVAY
LIQUID CHLORINE

NORIT

We invite you to try NORIT activated carbon in your plant. Our technical staff is at your Service

for information write
L. A. SALOMON & BRO.
Selling Agents
216 Pearl Street, New York
AMERICAN NORIT CO., Jacksonville, Fla.
See us at New Orleans

(Continued from page 36)

Charles J. Malmros, Jr., of Highland Park, N. J., died on March 13th, following an operation. Mr. Malmros was 55 years old. He had been superintendent of the Highland Park Water Department since its organization in 1928, and had also served the Borough as chief of its fire department. He had been a member of the American Water Works Association since 1929.

Pat Bracken, a founder of the former Southwestern Water Works Association, which is now the Southwest Section of the A. W. W. A., died on April 7th at his home in Baytown, Texas. He was an honorary member of this Association and had a host of friends in the waterworks field, especially among his associates in the Texas area.

(Continued on page 42)

THE STANDARD
for more than
50 YEARS

WATER WORKS SPECIALTIES

•

Automatic Pressure Control Valves

Pressure Reducing-Altitude

Surge-Relief and Combination Valves

Portable Fire Hydrants

Hydraulic Booster Pumps

ROSS VALVE MFG. CO., INC. TROY, N. Y.

GOOD NEWS SPREADS FAST

Protect your pool patrons with PERMUTIT water . . . . Conditioned automatically!

IT PAYS TO PLAY SAFE

How would you like to have PURE, *safe* water—water that is actually purer than drinking water standards? How would you like to keep it that way all day—*seven days a week?* Permutit makes that easy. Permutit equipment removes dirt, color and germs from water. *And it works automatically.* It purifies and re-purifies every drop of water in your pool three or more times a day! This saves time of draining and cleaning pool. It saves pumping in fresh water. It allows seven-day-a-week operation (won't the public cheer!)

HURRY—SUMMER IS COMING

Forget your worries about swimming-pool water. You can assure your taxpayers of pure, SAFE water and cut pool expenses at the same time when you install Permutit Equipment. Write today for 40-page manual . . . swimming-pool layouts . . . specifications. No obligation. Address The Permutit Company, Dept. G2, 330 West 42nd St., N. Y.

PERMUTIT SWIMMING-POOL EQUIPMENT
Automatic Filters • Hair Catchers • Suction Cleaners • Chlorinators • Chemical Test Sets Lights (for underwater illumination) • Recirculating Backwash Pumps • Special Pool Fittings • Inlets • Outlets • Scum Drains, • etc. Heaters • Ammoniators • Automatic Chemical Feeders

Permutit
The Water Conditioning Headquarters
for 25 years

MABBS

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

(Continued from page vi)

STEVENS, LOUIS R. Med. Laboratory, Ford Motor Co., Dearborn, Mich.

STANNARD POWER EQUIPMENT CO. 53 W. Jackson Blvd., Chicago, Ill. (Assoc. M.)

THOMPSON, H. M. Mgr., Hercules Powder Co., Paper Makers Chem. Div., P. O. Box 153, Sta. A, Atlanta, Ga.

TOWNSEND, HAL C. 6218 Argyle Ave., Dearborn, Mich.

GENERAL UTILITY CO. LTD. Alexander Leith Murray, Manag. Dir., 1029 Marine Bldg., Vancouver, Canada (Corp. M.)

VANNOY, F. R. Sales Rep., Neptune Meter Co., P. O. Box 343, Madisonville, Ky.

VAN PRAAG, ALEX, Jr. Vice-Pres. and Sec., Warren & Van Praag, Inc., 416 Millikin Bldg., Decatur, Ill.

WARD, HARRY W. 2122 First Street, Wyandotte, Mich.

WARREN, W. D. P. Pres., Warren & Van Praag, Inc., 416 Millikin Bldg., Decatur, Ill.

Reinstatements

CHILDS, FRED S. 106 Broad Street, Room 248, Newark, N. J.

Resignations and Deaths

ERIE COMMISSIONERS OF WATER WORKS. Mr. A. O. Chapin, Pres., Box 1217, Erie, Pa. (Corp. M.)

HURD, CHARLES H. Consulting Engineer, 1041 Architects & Builders Bldg., 333 North Pennsylvania St., Indianapolis, Ind.

KLINE, HUBERT S. Chief Chemist, Dept. of Water, 5 Palmer Street, Dayton, Ohio.

MCWANE, A. T. Vice-Pres. & Treas., McWane Cast Iron Pipe Co., Box 2601, Birmingham, Ala.

PLATT, B. H. Village Manager, Village Hall, Wilmette, Ill.

WIGHTMAN, C. R. Director of Public Works, Benton Harbor, Mich.

WILSON, JOHN J. Dist. Engr., National Tube Co., 415 Continental Bldg., Denver, Colo.

WITTWER, NORMAN C. Civil Engineer, Box 186, Rahway, N. J.

A Branch Connection While the Water Flows

QUICKLY, easily, safely, a 30" branch connection can be cut into a 30" or larger main by the use of a Smith Tapping Machine while the water in the main flows merrily along under its usual full head of pressure.

Shut-downs are avoided. They are unnecessary. Expense is saved. Danger is avoided. Health is protected.

This machine is power-operated. It uses an air-motor which supplies a smooth, steady flow of power which enables it to cut through the hardest main in less than an hour.

Other sizes of Smith Tapping Machines will make branch connections from 2" to 42" into any size mains not smaller in diameter than the connection desired.

Smith Tapping Machines are standard equipment today in the water and gas fields.

Send for full details

SMITH TAPPING MACHINES

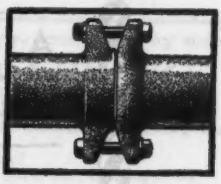
The A. P. Smith Manufacturing Company
East Orange, New Jersey

Smith Tapping Machines—Tapping Sleeves and Valves—O'Brien Hydrants—Valve-Inserting Machines—Removable Plugs, Pipe Cutting Machines—Corporation Tapping Machines—Gas Tee-Inserting Machines—Corporation Cocks—Federal Water Meters.

THE A. P. SMITH MFG. CO. EAST ORANGE, N.J.

UNIVERSAL CAST IRON PIPE

LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

THE CENTRAL FOUNDRY COMPANY

General Offices: 386 FOURTH AVENUE, NEW YORK

CHICAGO, ILL., 1105 W. 36th St. - OAKLAND, CALIF., 278 Fourth St.

OFFICES IN PRINCIPAL CITIES COAST TO COAST

(Continued from page 38)

Costs of public relief in February (1938) continued the rise recorded for the 4 preceding months, according to figures issued by the Social Security Board. Total Federal, State, and local costs incurred for aid to the needy in February, including earnings under the Works Program, amounted to $216,600,000, an increase of approximately $10,200,000, or about 5 per cent, over the total for January. It was pointed out, however, that the February increase was smaller than that recorded for the previous month.

The figures reported by the Board are compiled regularly in collaboration with other Federal agencies and State and local authorities. The February figure includes amounts for the various programs as follows: Public assistance to the needy aged, to the needy blind, and to dependent children from Federal, State, and local funds under the Social Security Act, and other public assistance of these special types, $40,634,000; earnings under the Works Program, including the Works Progress Administration and other Federal agencies through which wages were paid to persons

(Continued on page 44)

FIRST QUALITY METERS EXCLUSIVELY

SPECIFY *American* or *Niagara*

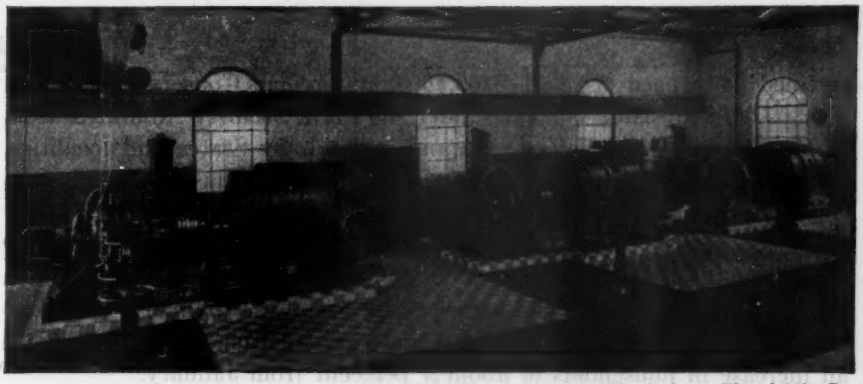
(BRONZE CASE) (IRON CASE)

Water Meters

WRITE FOR CATALOG

BUFFALO METER COMPANY

Established 1892 2914 Main St., Buffalo, N. Y.



Photos courtesy of Westinghouse Elec. & Mfg. Co.

Better

WATER SUPPLY

for PHILADELPHIA

The new East Park Pumping Station at Philadelphia is designed to improve conditions in the downtown section, to meet excess hot weather demands for South Philadelphia, and to act as a standby for the Belmont Station.

3 DE LAVAL PUMPS

driven by synchronous motors have a capacity of 25 m.g.d. each against 149 ft. head, or 20 m.g.d. against 170 ft. Field tests showed over 85 per cent wire-to-water efficiency.

The Philadelphia Water Works System now has twenty De Laval pumping units of approximately 445 m.g.d. aggregate capacity, in raw water, domestic and wash water service, installed in the East Park, Torresdale, Shawmont, Roxborough, Lardner's Point, Chestnut Hill, Queen Lane and Belmont Pumping Stations. In addition, there are numerous De Laval pumps supplying hydraulic pressure, feeding boilers, circulating condenser water, etc.

Further particulars are given in Leaflet PPE.

DE LAVAL STEAM TURBINE COMPANY

Trenton, New Jersey

Manufacturers of Steam Turbines, Centrifugal Pumps, Propeller Pumps, Rotary Displacement Pumps, Centrifugal Blowers and Compressors, Worm Gears, Helical Gears, Hydraulic Turbines, Flexible Couplings. Sole Licensee of the Bauer-Wach Exhaust Turbine System. 4091

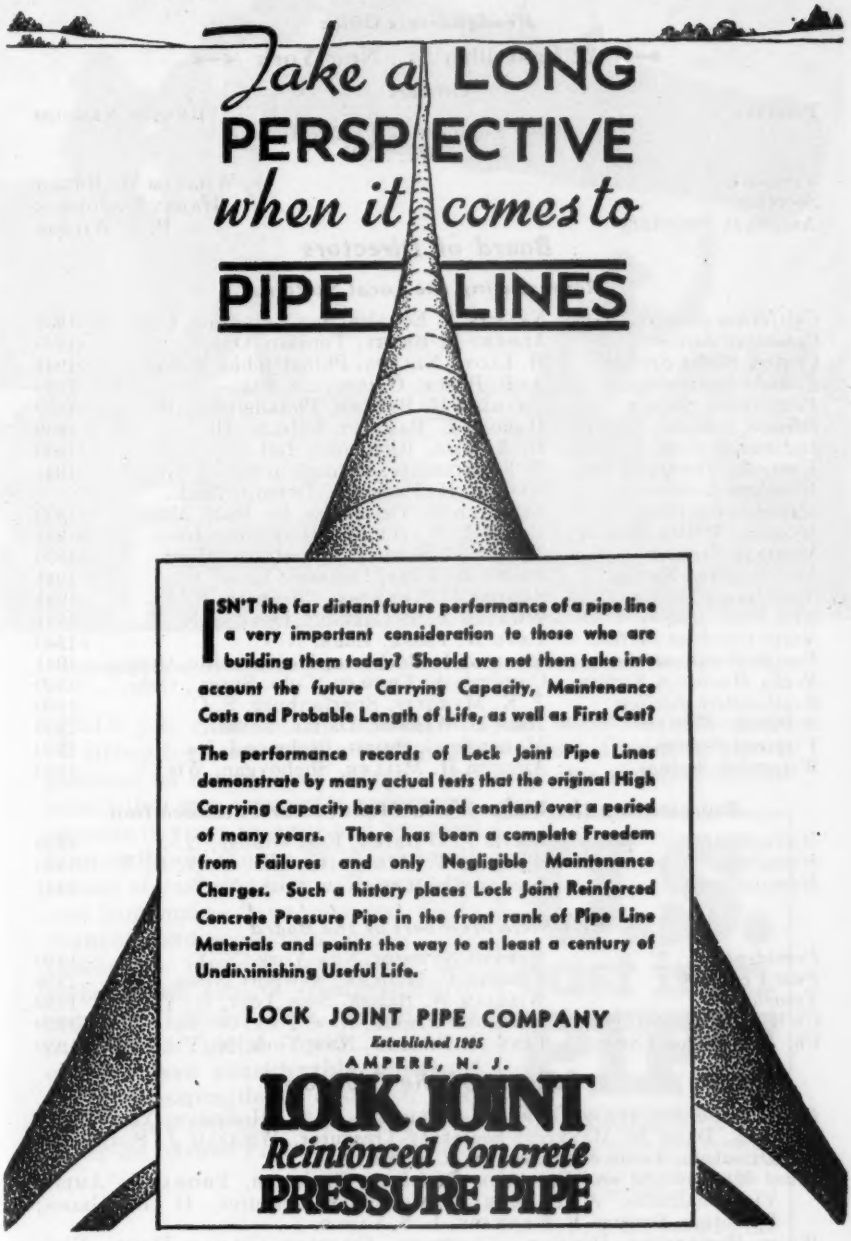
(Continued from page 42)

certified as in need of relief, $106,560,000; Civilian Conservation Corps, $19,309,000; subsistence grants under the Farm Security Administration, $2,474,000; general relief in cash and in kind, by States and localities, $47,651,000. These sums represent aid received by the needy; administrative costs are not included.

On the basis of reports received by the Board it was estimated, after allowance for duplications, that in February approximately 6 million different households, probably comprising about 18.5 million persons, received public aid of one or more of the types mentioned above. This is an increase in households of about 7 per cent from January.

In each of the major types of public aid except the Civilian Conservation Corps, costs for February were higher than for those in January. There was a rise of 9.6 per cent in earnings under the Works Program, while subsistence grants under the Farm Security Administration increased by 11.9 per cent. General relief provided by States and localities for February increased by less than 2 per cent over that for the preceding month. It was pointed out that the total cost of Federal, State, and local aid to persons in need for February was $1,290,000 above the total cost for February 1937. It was emphasized that the figures reported indicate only the amount of aid provided and are not necessarily a measure of the extent of need for relief, since in some communities local funds may not have been available for aid to all the persons who were eligible to receive it under Federal, State, or local programs.

According to reports from States coöperating in public assistance programs under the Social Security Act, costs of nearly $40,000,000 were incurred in February for payments from Federal, State, and local fund to recipients of old-age assistance, aid to the blind, and aid to dependent children. In February there were 1,632,802 recipients of old-age assistance in 47 States, the District of Columbia, Alaska, and Hawaii, comprising approximately 21 per cent of the estimated population aged 65 and over. The average payment per recipient was $19.34 for that month. The size of the average payment per recipient ranged from 14.57 in Mississippi to $32.91 in California. In 37 States, the District of Columbia, and Hawaii, making payments under the program for February, aid was extended to 46,401 blind persons. The average payment for the month was $25.49. In 38 States, the District of Columbia, and Hawaii, aid was provided for February on behalf of 558,543 dependent children in 225,273 families. The average monthly payment was $32.02 per family.



ISN'T the far distant future performance of a pipe line a very important consideration to those who are building them today? Should we not then take into account the future Carrying Capacity, Maintenance Costs and Probable Length of Life, as well as First Cost?

The performance records of Lock Joint Pipe Lines demonstrate by many actual tests that the original High Carrying Capacity has remained constant over a period of many years. There has been a complete Freedom from Failures and only Negligible Maintenance Charges. Such a history places Lock Joint Reinforced Concrete Pressure Pipe in the front rank of Pipe Line Materials and points the way to at least a century of Undiminishing Useful Life.

LOCK JOINT PIPE COMPANY

Established 1905

AMPERE, N. J.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

AMERICAN WATER WORKS ASSOCIATION

Headquarters Office

22 East 40th St., New York

Officers

President	REEVES NEWSOM Consulting Engineer, 500 Fifth Avenue New York, N. Y
Treasurer	WILLIAM W. BRUSH
Secretary	HARRY E. JORDAN
Assistant Secretary	P. S. WILSON

Board of Directors

Representing the Local Sections

California Section	NELSON A. ECKART, San Francisco, Cal.	to–1939
Canadian Section	ALBERT E. BERRY, Toronto, Ont.	–1940
Central States Section	H. LLOYD NELSON, Philadelphia, Penna.	–1941
Florida Section	A. P. BLACK, Gainesville, Fla.	–1939
Four States Section	CHARLES H. BECKER, Philadelphia, Pa.	–1939
Illinois Section	HAROLD E. BABBITT, Urbana, Ill.	–1939
Indiana Section	H. A. DILL, Richmond, Ind.	–1940
Kentucky-Tennessee Sect.	E. E. JACOBSON, Lexington, Ky.	–1941
Michigan Section	GEORGE H. FENKELL, Detroit, Mich.	
Minnesota Section	LEONARD N. THOMPSON, St. Paul, Minn.	–1939
Missouri Valley Section	EARLE L. WATERMAN, Iowa City, Iowa	–1941
Montana Section	JOSEPH M. SCHMIT, Lewistown, Mont.	–1939
New England Section	ROGER W. ESTY, Danvers, Mass.	–1941
New Jersey Section	SAMUEL F. NEWKIRK, Elizabeth, N. J.	–1941
New York Section	WILLIAM A. MCCAFFREY, Oswego, N. Y.	–1941
North Carolina Section	PAUL W. FRISK, Enka, N. C.	–1940
Pacific Northwest Sect.	MILTON H. MCGUIRE, McMinnville, Oregon	–1941
Rocky Mountain Section	CHESTER A. TRUMAN, Colo. Sprgs., Colo.	–1940
Southeastern Section	J. K. MARQUIS, Spartanburg, S. C.	–1940
Southwest Section	JOHN B. WINDER, Dallas, Texas.	–1939
Virginia Section	MARSDEN C. SMITH, Richmond, Va.	–1940
Wisconsin Section	ARTHUR H. MILLER, Sheboygan, Wis.	–1940

Representing the Water Works Manufacturers Association

Manufacturer	DENIS F. O'BRIEN, East Orange, N. J.	–1939
Manufacturer	WILLARD T. CHEVALIER, New York, N. Y.	–1940
Manufacturer	CLINTON INGLEE, New York, N. Y.	–1941

Ex-Officio Members of the Board

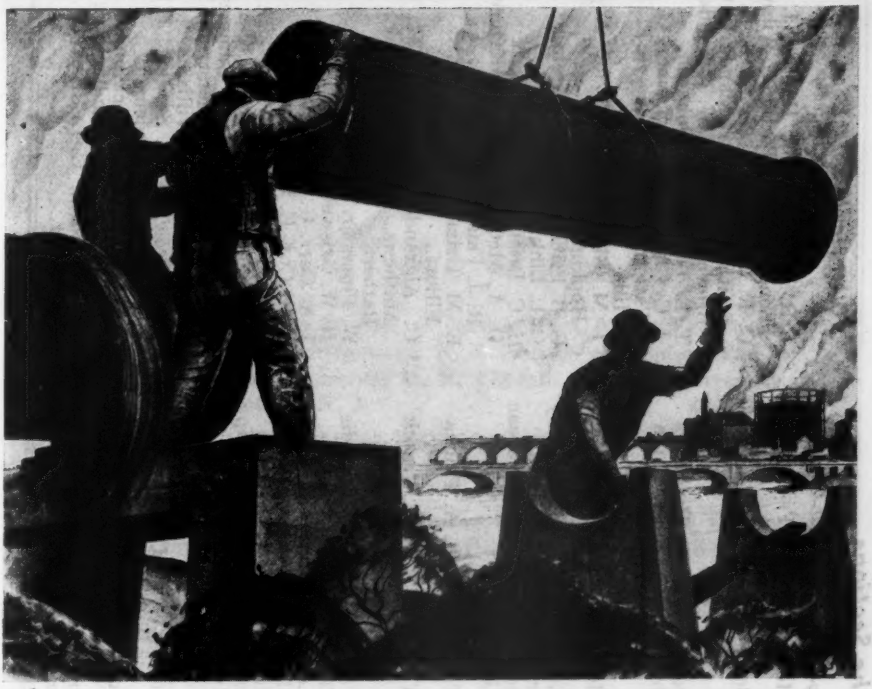
President	REEVES NEWSOM, New York, N. Y.	–1940
Past President	EUGENE F. DUGGER, Newport News, Va.	–1939
Treasurer	WILLIAM W. BRUSH, New York, N. Y.	–1939
Ch. W. W. Practice Comm.	MALCOLM PIRNIE, New York, N. Y.	–1939
Ch. Publication Comm.	LINN H. ENSLOW, New York, N. Y.	–1939

Officers of the Divisions

Finance and Accounting Division.—Chairman, M. F. HOFFMAN; Vice-Chairman, DALE L. MAFFITT; Secretary-Treasurer, WILLIAM J. SCHWARTZ; Directors, JACOB SCHWARTZ, HAL F. SMITH.

Plant Management and Operation Division.—Chairman, THOMAS L. AMISS; Vice-Chairman, A. P. KURANZ; Secretary-Treasurer, D. D. GROSS; Directors, SAMUEL F. NEWKIRK, L. S. VANCE.

Water Purification Division.—Chairman, CHARLES GILMAN HYDE; Vice-Chairman, CHARLES H. SPAULDING; Secretary-Treasurer, CHARLES R. COX; Additional members of Executive Committee, M. C. SMITH, PAUL WEIR.



Lithographed on Stone by James E. Allen for U. S. Pipe & Foundry Co., Copyright 1937, U. S. Pipe & Foundry Co.

THE job calls for a corrosion-defying material with great strength to cope with a variety of stresses. Cast iron pipe is specified as a matter of course. But even the simplest routine installation may encounter unforeseen stresses in years to come and be saved from untimely failure by these safety factors of cast iron pipe. Century-old cast iron mains have survived vastly changed conditions and stresses. Advances in foundry technology and metallurgical control—represented by Super-de Lavaud Pipe, centrifugally cast in a metal mold *without chill*— have considerably enhanced the stress-strengths of cast iron pipe. The impact strength, for example, of Super-de Lavaud Pipe is extraordinary.

U.S.
cast iron
PIPE

Cast iron and alloy cast iron pipe centrifugally or pit cast—for water works, gas, sewerage and drainage service as well as industrial uses involving corrosives.

U. S. Pipe & Foundry Co.
BURLINGTON, N. J.

Foundries and Sales Offices throughout the U. S.

Officers of the Sections

Section	Chairman	Vice-Chairman	Secretary-Treasurer	Past-Chairman	Other Members of the Section Governing Board[2]
California	J. E. Phillips	H. Reinhardt	C. M. Hoskinson	R. F. Brown	J. R. Barker, G. W. Hawley, J. S. Longwell, F. S. Porter, C. Wilson.
Canadian	A. B. Manson	—	A. E. Berry	E. V. Buchanan	C. E. Brown, L. G. McNeice, R. J. Smith, G. H. Strickland, F. G. Browne, W. Storrie, W. T. Randall.
Central States	E. C. Trax	W. C. Lawrence	E. P. Johnson	R. Hulbert	T. L. Young, E. A. Johnson.
Florida	D. S. Wallace	T. M. Lowe	J. R. Hoy	K. R. Chinn	J. C. Chalfant, J. R. Tanner, G. F. Catlett, R. G. Ridgely, F. R. Mills.
Four States	H. M. Freeburn	C. J. Lauter	C. A. Hechmer	E. B. Whitman	I. M. Glace, G. R. Taylor, E. S. Hopkins, A. Wolman.
Illinois	W. D. Gerber	F. G. Gordon	C. W. Klassen	F. C. Amsbary	G. B. Prindle, H. H. Gerstein.
Indiana	P. C. Laux	M. H. Schwartz	J. A. Bruhn	J. L. Ford	C. L. Link.
Kentucky-Tenn.	C. M. McCord	H. Arnold	H. D. Schmidt	E. E. Jacobson	H. C. Bristol, H. N. Jernigan.
Michigan	E. E. Norman	C. R. Bird	M. N. Gerardy	—	O. A. McCarthy, L. E. McQueen, R. J. Faust.
Minnesota	F. Seligman	J. A. Jensen	R. M. Finch	R. A. Thuma	E. M. Grime, A. C. Janzig, C. L. Elliott.
Missouri Valley	D. L. Maffitt	B. L. Ulrich	E. L. Waterman	N. T. Veatch	C. Alexander, C. Hoen, E. R. Mathews, L. M. Nelson, F. A. Rathert.
Montana	R. N. Arnold	G. E. Atkinson	H. B. Foote	F. E. Brandis	W. Plummer, A. J. Roberts.
New England	S. S. Anthony	F. A. Marston	S. M. Ellsworth	W. J. Scott	H. W. Griswold, P. A. Shaw.
New Jersey	W. R. Conard	G. F. Wieghardt	H. N. Lendall	S. F. Newkirk	J. A. Carr, C. H. Capen.
New York	E. L. H. Meyer	F. Henshaw	R. K. Blanchard	A. D. Drake	C. R. Cox, E. K. Wilson.
North Carolina	J. W. Kellogg	R. A. Thomas	A. R. Hollett	H. G. Baity	
Pacif. Northwest	M. H. McGuire	N. A. Gilman	F. Merryfield	A. H. Labsap	H. D. Fowler, R. E. Koon.
Rocky Mountain	O. J. Ripple	—	B. V. Howe	P. S. Fox	K. W. Caldwell, O. B. Summers, B. G. Coy, J. P. Soderstrum, K. F. Darling, L. O. Williams.
Southeastern	C. P. Townsend	P. Weir	B. P. Rice	D. R. Pringle	F. G. Crow, M. G. Stewart, J. H. McLure, H. F. Wiedeman
Southwest	T. L. Amiss	A. R. Davis	L. A. Quigley	H. E. Nunn	R. W. Harding, L. A. Jackson, A. F. Theard, M. T. Vanlandingham.
Virginia	H. B. Rice	H. A. Johnson	H. W. Snidow[1]	A. L. Meisel	E. C. Meredith,[1] C. L. Crockett.
Wisconsin	W. U. Gallaher	W. C. Staeffler	L. A. Smith	C. Gruetzmacher	A. E. Hintz.

[1] Virginia Section—Secretary is H. W. Snidow; Treasurer E. C. Meredith

[2] For Section's representative on the A. W. W. A. Board of Directors, see list on page ii

COMING MEETINGS

May 25–26—Florida Section, at Williams Hotel, Daytona Beach, Florida. Secretary, J. R. Hoy, 404 Hildebrandt Bldg., Jacksonville, Fla.

May 25—New Jersey Section, at New Milford, N. J. (Hackensack W. Co.) and at Ridgewood, N. J. (Village water plant and at Elks' Club). Secretary H. N. Lendall, Rutgers University, New Brunswick, N. J.

Aug. 17–19—Central States Section, at Hotel Windsor, Wheeling, West Virginia. Secretary, E. P. Johnson, 418 Flannery Bldg., Sta. 13, Pittsburgh, Pa.

Sept. 12–15—Rocky Mountain Section, at Townsend Hotel, Casper, Wyoming. Secretary, B. V. Howe, State Office Building, Denver, Colo.

Sept. 13–16—New England Water Works Association, at Hotel Statler, Boston, Mass. Secretary, Frank J. Gifford, Statler Building, Boston, Mass.

Sept. 22–23—New York Section, at Nelson House, Poughkeepsie, N. Y. Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

Sept. 29–Oct. 1—Minnesota Section, at Minneapolis, Minn. Secretary, R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

October 6–7—Four States Section, at Washington, D. C. Secretary, Carl A. Hechmer, Washington Suburban Sanitary District, Hyattsville, Md.

October 13–15—Missouri Valley Section, at Hotel Fort Des Moines, Des Moines, Iowa. Secretary E. L. Waterman, University of Iowa, Iowa City, Iowa.

October 17–20—Southwest Section, at Hotel Biltmore, Oklahoma City, Okla. Secretary, L. A. Quigley, Supt., City Water Works, Fort Worth, Texas.

October 26–29—California Section, at Mission Inn, Riverside, Calif. Secretary, Carl M. Hoskinson, Div. of Water, Sacramento, Calif.

CHANGES IN MEMBERSHIP

New Members, Applications Received March 1 to 31, 1938

ANDERSON, CLARENCE S. Supt. of Public Works, Mun. of Twp. of Tisdale, South Porcupine, Ont., Canada.

AUSTIN, RALPH D. City Engr., Supt. Water, City Hall, Little Falls, N. Y.

BLAIR, CLARENCE M. Consulting Engr., Room #4, 100 Crown St., New Haven, Conn.

BOND, ROBERT M. Asst. Accountant—Mun. Section, 620 University Ave., Toronto, Ont., Canada.

BOUCHER, GEORGE. Supt., Paris Public Utilities Commission, Box 180, Paris. Ont., Canada.

BREADY, IRA J. Sales Engineer, The Permutit Co., 3316 Lambert Place, Cincinnati, Ohio.

BRINTNELL, F. M. Sec.-Treas., Public Utilities Commission, Colborne, Ont., Canada.

CAPLAN, SALEM D. Jr. Civil Engr., 1617½ Rendall Place, Los Angeles, Cal.

CHAMBERS, GROVER. Water Supt., Cheney, Wash.

CLARKE, AUBREY B. Topographic Draftsman, Bureau of Water Works & Supply, Box 240, Arcade Annex, Los Angeles, Calif.

CONNELL, C. H. Chief Chemist, Water Div., Texas State Dept. of Health Laboratories, Austin, Texas.

DAHLJELM, IRVING L. Supt. of Filtration, Highland Park Filter Plant, 1973 East Division Ave., Detroit, Mich.

DILLON, G. M. Supt. Public Works, Borough of Braddock, Pa., 727 Braddock Ave., Braddock, Pa.

DRAVES, HARRY J. Acting Supt., 321 Franklin St., Michigan City, Ind.

CITY OF EAST HELENA. Water Department, East Helena, Mont. (Corp. M.)

ELLIS, RICHARD H. Engr., 184 High Street, Boston, Mass.

ENTWHISTLE, RICHARD R. Sr. Chemist & Bact., Covington Water Works, Covington, Ky.

FAWKES, A. W. ELLSON. C.E., R.P.E., City of Moose Jaw, Moose Jaw, Sask., Canada.

FLEXIBLE SEWER ROD EQUIPMENT CO. Mr. H. R. Crane, 622 East 4th Street, Los Angeles, Calif. (Asso. M.)

GAUTHIER, C. W. Supt., Belle River, Ont., Canada.

GENERAL PAINT CORP. (Hill, Hubbell & Co. Div.), Mr. Deming Brinson, Vice-Pres., 3091 Mayfield Road, Cleveland, Ohio. (Asso. M.)

GRAN, JOHN E., Dr. School of Chemistry, University of Alabama, University, Ala.

GRAY, MAXIM T. Hogly, Gray & Plunkett, Ltd., Box 134, Ft. Erie, Ont., Can.

GUTTING, L. A. Mgr., Pub. Ser. Co. of Indiana, Shelbyville, Ind.

HARLAN MUNICIPAL WATER WORKS. Mr. C. H. Franklin, Mgr., Harlan, Ky. (Corp. M.)

HAZEN, JOHN B. General Foreman, Butte Water Co., Butte, Mont.

HENRY, FRANCIS WM. Supt. of Phelps Water Works, 131 West Main St., Phelps, N. Y.

HERBERT, E. H. Asst. Engr., Div. of Water Supply, Norfolk, Va.

HOWE, HENRY L. City Engr., 52 City Hall, Rochester, N. Y.

JAMES, ELMO. Construction Foreman, W. 2626 Euclid Ave., Spokane, Wash.

JONES, FRED D. Chief Meter Inspector, Room 305, City Hall, Spokane, Wash.

JUDD, THOS. H. Engr., Washington Water Power Co., Spokane, Wash.

KINNEY, E. F. Sales Engr., Wallace & Tiernan Co., 5414 Broadway, Indianapolis, Ind.

(Continued on page 38)

NEWS OF THE FIELD

The Barkley-Vinson-Lonergan Stream Purification Bill has been deadlocked in the hands of the Senate-House Conference Committee since last August. Valuable legislation, highly important to sanitary engineers and to water supply officials, is being held up by the insistence of certain groups whose concept of the problem is in terms of punitive rather than constructive and cooperative activity. Acceptance of the viewpoints of Congressmen Vinson and Mansfield, which are in line with the expressed opinions of the A.W.W.A. Board of Directors, would permit the passage of this much needed bill. It is not too late for members of this Association individually to urge their Senators or Representatives to agree upon the reasonable form of this bill and put it forward for passage.

During the New Orleans convention, several important Association activities were brought to the point of completion.

Members of the Association will remember that the February, 1938 Journal carried the Tentative Standard Specifications for Laying Cast Iron Pipe. This activity, under various chairmen, has been in progress for a number of years. The committee was reorganized at the beginning of 1937 with William C. Mabee, of Indianapolis, as chairman and with the addition of new personnel actively engaged in distribution practice in the various water departments of the country. The committee has been very diligent and presented a report at the January meeting of the board of directors. The report was approved in principle and ordered printed. Since that time, it has been freely discussed by persons not previously acquainted with it and a few minor modifications by way of footnotes have been added. The specification was changed in no major point from the form in which it appeared in the February Journal. It was finally approved by the Board of Directors at the close of the New Orleans convention and will shortly be available in reprint form for the use of any interested person.

Following the recommendation of the Water Works Practice Committee, developed at its meeting on Monday afternoon of the convention, the board of directors, at the close of the convention, approved the Specifications for Gate Valves as standard for A.W.W.A. practice. The effective date of these specifications is May 1, 1939. In other words, it was decided to give both the producing and the consuming field ample opportunity to acquaint themselves with the changes that have been made in the specifications for gate valves and it was deemed advisable to make this interval at least a year in length.

(Continued on page 2)

(*Continued from page 1*)

Perhaps few of the members of the Association realize the tremendous amount of work and time that has been expended upon this specification. The Water Works Practice sub-committee assigned to this task was appointed on December 7, 1929 and from that period until the present date there has been practically continuous discussion and work done on the specification. It has been a highly difficult task because of the necessity of adjustment between some demands for improvement upon the part of the consuming group and some requests for little change upon the part of the producing group.

As it now stands, the specification is in the main not different from the one published in the Journal in March, 1937. The footnotes at the end of the main body of the specifications as published have been deleted. The tabulation as to minimum thickness of castings has been added to the main body of the text as Section 5.3. It is introduced into the text of the specifications simply to supplement the fundamental requirements concerning quality of castings included in Section 5.1 and to record a list of thickness requirements below which it is considered unlikely that sufficient strength would exist for safety.

Another project which covers much briefer time, but in which the Association is also broadly interested, is the Water Works Accounting Manual. This will be remembered as a joint project of the Municipal Finance Officers' Association and the A.W.W.A., and the expense of preparing the text has been underwritten by a grant from the Spellman Foundation. That there is great need for such a document has been evidenced by the experience of both associations concerned, and the completion of the document, together with its approval by our Finance and Accounting Division, represents a commendable activity. Final revision of the phraseology is now in progress and the completed document will be submitted for the joint approval of the President and the Secretary of the A.W.W.A. Publication is promised during the summer and the book should be available for sale by September of this year.

The Steel Plate Pipe Specifications Committee held several meetings with representatives of the producers during the convention. Under the chairmanship of W. W. Hurlbut, the committee has, within the past year, drawn up suggested specifications for Riveted, Lock-Bar and Welded Steel Pipe, and for Protective Coatings. The committee proposes to take into account the suggestions made by the producers of pipe and coatings and to make the revised text available to interested persons before it is presented to the Board of Directors for approval as a tentative specification.

(*Continued on page 4*)

NOTHING TAKES THE PLACE OF WATER

NOTHING TAKES THE PLACE OF CAST IRON PIPE

Water is indispensable to human existence—cast iron pipe is indispensable to long life and economy in an underground main—nothing takes their place. Great progress has been made in the purification and distribution of water supply, as well as in the manufacture of cast iron pipe.

If you demand *proved* long life and low maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—and permanently tight joints—then you will agree that *nothing takes the place of cast iron pipe.* Some materials meet some of these requirements but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE

The Standard Material Q *for Underground Mains*

(*Continued from page 2*)

The Association can well be proud of the activity of its members on these standardization projects. It is the sort of thing that an association must stimulate its constituency to do if it really amounts to what it should. The A.W.W.A. is definitely moving forward in this respect.

The American Public Works Association's Yearbook for 1938 contains material which adequately reviews and appraises the recent developments in all phases of the public works field.

Attempting to embrace the entire public works field, Part One of the book reviews for all levels of government the major events in public works programming, organization, personnel administration, budgeting and accounting, financial relationships between federal, state and municipal governments, property tax limitations and gas tax revenues in addition to an extensive treatment of the many technical phases of public works engineering. This review and appraisal is supplemented and developed at length by Part Two of the volume, which is entitled "Current Problems in Public Works," and which reports the discussions which took place at

(*Continued on page 8*)

Speed up
your PIPE JOINTING

No need to wait days for leaks to heal. Made with Tegul-MINERALEAD joints meet any reasonable leakage specifications at once. Trenches can be backfilled and premises cleared up. • Joints are permanently tight. • The 10 lb. ingots are easy to ship, store and handle; impervious to water—can be stored outdoors. Correctly mixed at plant, *this* compound cannot change composition in transit to the job.

A Tegul PRODUCT

Tegul-

MINERALEAD

For booklet, address

The ATLAS MINERAL Products Company
of Pennsylvania
Mertztown . . . . Pennsylvania

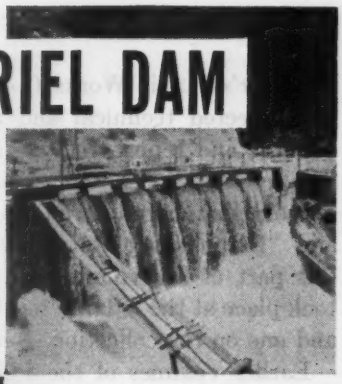
OVER 500 municipalities use American or New York Continental Jewell Water purification equipment.

WATER FILTERS
WATER SOFTENERS

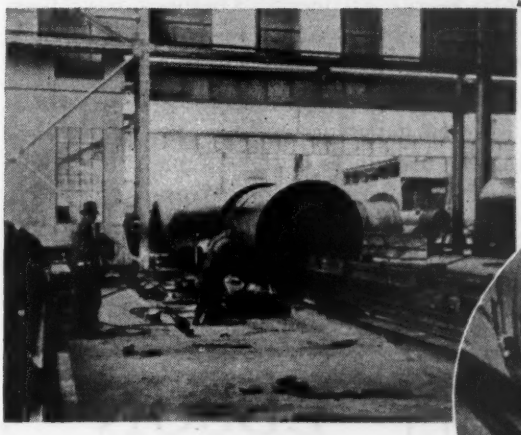
Proportionate Electro-Magnetic Chemical feeders for feeding lime, acid, alum, soda ash, etc.

AMERICAN WATER SOFTENER COMPANY
Lehigh Avenue and 4th St.
Philadelphia, Pa.

☆ AT THE SAN GABRIEL DAM



Reilly PIPE ENAMEL AND PRIMER provides permanent protection for Conduits



• Above: *Photograph of Dam, showing discharge through 51" venturi tubes.*

• Left: *Application of Reilly Pipe Enamel.*

• Below: *Installing 96" x 40' steel tubes after coating with Reilly Enamel and Primer.*

IN MAJOR construction projects, such as the San Gabriel Dam, pictured here, Reilly Pipe Enamel and Primer is relied upon for protection of pipe lines and conduits against rust, corrosion, tuberculation, and other destructive agents. Reilly Enamel provides a coating that is resistant to abrasion, withstands high temperatures approaching 200° F. without flow or sag—and temperatures as low as minus 20° F., without cracking or peeling. Easily applied by centrifugal spinning, rolling rig, or hand daubing.

Recommended specifications and complete information on any special protective coating problems will be supplied, promptly on request.

Reilly COAL TAR PRODUCTS

•

(Photographs reproduced here by permission of Los Angeles County Flood Control, San Gabriel Dam No. 1.)

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN · PLANTS · TO · SERVE · YOU

(*Continued from page 4*)

last year's Public Works Congress held in Atlanta. It is in this section that selected technical and administrative problems are given detailed analysis and report, including such topics as "Planning Problems of the Smaller City," "Administering Public Services During a Great Flood," "Birmingham's Industrial Water Supply," "Atlanta's Refuse Incinerator," and "Establishing Rates for Small Municipal Utilities." In addition, this part of the volume reports two lengthy informal discussions which took place at the Atlanta meeting: one on public works personnel problems and one on the collection of refuse.

Earlier volumes of the Public Works Engineers' Yearbook have been restricted in content to the prepared papers and impromptu discussions presented at the annual Public Works Congress. The extension of the present volume to include material which in effect epitomizes the experiences of the year just passed is a new departure and has been undertaken with the intention of increasing the usefulness of the volume. It may be obtained for $3.50 per copy from the American Public Works Association, 1313 East 60th St., Chicago, Illinois.

(*Continued on page 12*)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

Hand Operated—size 2″, 2½″, 3″, 4″
Power Operated—size 3″ and 4″
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

"ON THE RIGHT TRACK"

ONE of our customers states: "I enjoyed the Nuchar movies very much. It is just a little hard for us, who have been using Nuchar for some time, to realize that any water superintendent could get himself into such a jam. Nuchar is a regular part of our purification process. When the filters are in operation, the Nuchar solution is also in operation. We find it a pretty reliable form of insurance. Until recently our lake water had no turbidity, and required very little coagulation, but activated carbon was used all during the period. Ordinarily we drain and clean our settling basins about every ninety days. During the period of low turbidity they were not drained for almost one hundred and eighty days, but when they were drained we found no disagreeable odor in the settled sludge. We do not feel that the small continuous dosage added to the raw water has cost us much, when it has prolonged the cleaning of basins, in addition to providing taste and odor insurance."

BE *"On the Right Track"* ● USE AQUA NUCHAR when confronted with tastes and odors in your water supply.

INDUSTRIAL CHEMICAL SALES DIVISION

OF WEST VIRGINIA PULP AND PAPER COMPANY

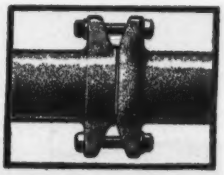
230 Park Avenue
New York, N. Y.

205 W. Wacker Drive
Chicago, Ill.

417 Schofield Bldg.
Cleveland, Ohio

UNIVERSAL CAST IRON PIPE

LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

THE CENTRAL FOUNDRY COMPANY

General Offices: 386 FOURTH AVENUE, NEW YORK

CHICAGO, ILL., 1105 W. 36th St. - OAKLAND, CALIF., 278 Fourth St.

OFFICES IN PRINCIPAL CITIES COAST TO COAST

Have you a Friend

Who should join the A. W. W. A.?

See that he signs the application blank on page 33 and sends it to headquarters

(*Continued from page 8*)

The U. S. Chamber of Commerce, at its recent meeting in Washington, adopted certain resolutions of interest to this Association. With reference to flood control, it was stated: "Flood control projects should be prosecuted in accordance with the Flood Control Act of 1936, and without delays and impediments contrary to the principles enacted in that legislation. Under the Act of 1936 states and their subdivisions are to provide the lands and rights-of-way for flood control structures. These costs are to be met by the benefited states or their political subdivisions, according to benefits, with agreements in the nature of compacts where two or more states are concerned as to such benefits and contributions among the interested states.

"Flood control structures, including dams, are to be maintained and operated by the interested state, or where there are two or more interested states, by compact agreement; and titles to these structures rest in the states.

"The first of these compacts was speedily entered into by New England states, and has since been pending in Congress without final action in the form of consent. The legislation of 1936 in content and intentions require

(*Continued on page 16*)

CLEAN YOUR WATER MAINS

One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

50 Church St., New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.

Lawrenceburg — Indiana

WELL SCREENS

To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.

2304 Long Avenue,
St. Paul, Minn.

SAVE 80% ON YOUR TRENCHING COSTS WITH A

GIANT PIPE PUSHER

10 DIFFERENT SIZES
TO FILL EVERY NEED
WRITE FOR CATALOG
Dept. P-3

GIANT MFG. CO.
Council Bluffs, Iowa

POMONA PUMPS

WATER LUBRICATED TURBINE

Oceans of Water

POMONA PUMP CO.
POMONA, CALIFORNIA
LOS ANGELES 406 S. MAIN ST. CHICAGO 53 W. JACKSON BLD.

Do you bind the Journal?
Are you satisfied with the price?
If not, please communicate with

AMERICAN WATER WORKS ASSOCIATION
22 East 40th St., New York City

(*Continued from page 12*)

that this and all similar compacts should have prompt consent from Congress, in order that provision for flood control works may go forward before new flood disasters occur."

With reference to water resources, this was adopted: "In any reckoning of national resources, the water and the land hold foremost place. The United States should develop land policies based upon studied considerations and suited to differing regional advantage. The beneficial use of water upon the land is a composite problem, for the solution of which the federal government and the states, in any programs of useful public works, may wisely expend public funds upon carefully planned projects that will stand the test of economically sound investments or repayment arranged upon a business basis. Experience teaches that projects so devised not only benefit the section where they are located, but contribute as well as to the wealth and welfare of the whole country."

Several hundred cities in the United States, facing unbalanced budgets and extensive tax delinquency, have resorted unwisely to the diversion of water revenue funds to general administrative purposes, according to

(*Continued on page 18*)

DIFCO

Confirmation of Coli

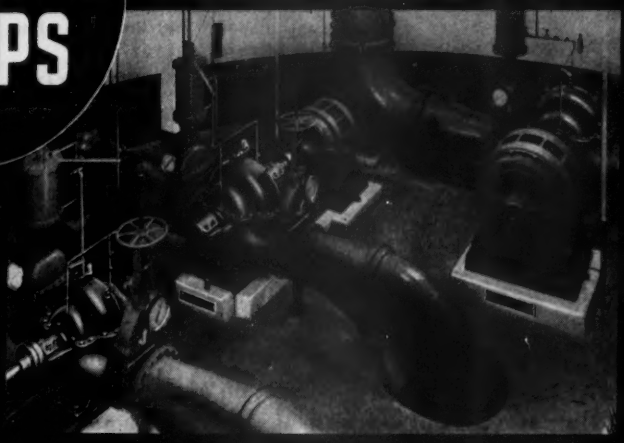
Levine's Eosin Methylene Blue Agar, Difco, is recommended for use in confirming the presumptive test for coliform organisms in water. When this dehydrated medium is prepared for use its formula conforms in every way to that approved in "Standard Methods of Water Analysis" of the American Public Health Association.

Upon plates prepared from this medium; colonies of *Escherichia coli* are dark and possess a metallic sheen, while those of *Aerobacter aerogenes* are wine colored and have no luster. Colonies of organisms which do not ferment lactose are transparent and uncolored.

Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

DIFCO LABORATORIES
INCORPORATED
DETROIT, MICHIGAN

DE LAVAL FOR INSURANCE PUMPS



Three De Laval general service pumps supplying a great industrial plant; capacities 7600 g.p.m. against 54.5 ft.; 12,000 g.p.m. against 56 ft.; and 19,000 g.p.m. against 60 ft., respectively.

A $5,000,000 plant, using water in large quantities and operating 24 hours per day the year around, depends for its water supply upon the three De Laval pumps shown in the photograph, continuous operation being provided by connections to a reservoir and to a city water works system.

De Laval pumps are designed with particular regard to reliability in service, viz:

1. The casings are split horizontally in the plane of the axis, so that internal parts are readily accessible and renewable without disturbing piping.
2. Labyrinth wearing rings, which protect casing and impeller and restrict leakage from discharge to suction, give longer life and sustain efficiency over longer periods than do flat wearing surfaces.
3. Parts subject to wear, such as bearings, shaft sleeves, casing bushings, and wearing rings, are made to limit gages on an interchangeable basis, so that renewals do not require to be fitted and can be inserted quickly.
4. De Laval pumps are guaranteed as to efficiency and other characteristics and are tested before shipment from our works.

State your requirements so that we may send data and literature.

3205

DE LAVAL *Steam Turbine Co.* TRENTON, N. J.

MANUFACTURERS OF STEAM TURBINES, PUMPS – CENTRIFUGAL, PROPELLER, ROTARY DISPLACEMENT, CENTRIFUGAL BLOWERS AND COMPRESSORS; WORM GEARS; HELICAL GEARS; HYDRAULIC TURBINES AND FLEXIBLE COUPLINGS • • • SOLE LICENSEE OF THE BAUER-WACH EXHAUST TURBINE SYSTEM

PICTURE OF SALVAGE VALUE

36" Cast Iron Pipe being reinstalled in new locations at Dallas, Texas, after 28 years service in old water supply line which was abandoned when supply source was relocated. For literature on high quality Cast Iron Pipe and Fittings for water works, sewage disposal and filtration plant work, address Acipco office nearest you.

AMERICAN CAST IRON PIPE CO.
Birmingham, Ala.
NEW YORK CITY CHICAGO KANSAS CITY MINNEAPOLIS
DALLAS LOS ANGELES SAN FRANCISCO PITTSBURGH CLEVELAND

(*Continued from page 16*)

E. B. Black, consulting engineer of Kansas City, Mo. Such diversions are running into millions of dollars annually and if continued, will throw the financing policies of many cities into disorder and will hamper seriously needed future waterworks construction and maintenance, he warned.

"How prevalent this misuse of water revenue is becoming is evidenced by a survey of Kansas municipalities. For the year 1936 it was found that 65 municipally-owned combined water and light utilities contributed from their revenue $319,741 to other city funds," said Mr. Black. "Of 500 municipally-owned utilities in the state, 150 of them in 1936 contributed $1,387,200 from their revenue to other city funds, and rate payers thus relieved general taxpayers of the burden of raising that amount in taxes.

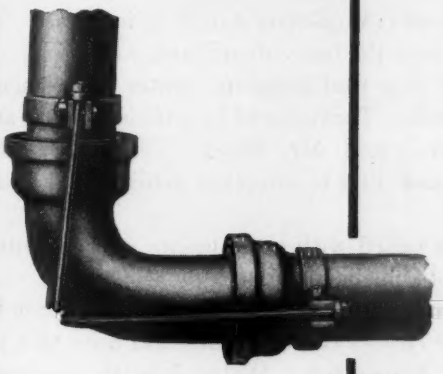
On the other hand, Mr. Black found that 109 water plants and three combined water and electric plants in Kansas in 1936 received $274,435 from general tax funds, and thus deficits in operating revenues were saddled on general taxpayers. Reviewing the Kansas situation, Mr. Black concluded that "obviously, rate payers to those plants that contributed revenue from collected rates to other city funds are entitled to rate reductions. The rates of those water utilities receiving money from other city

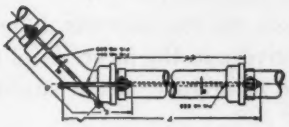
(*Continued on page 20*)

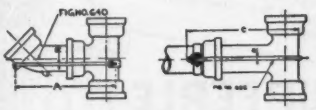
FIRST QUALITY METERS EXCLUSIVELY

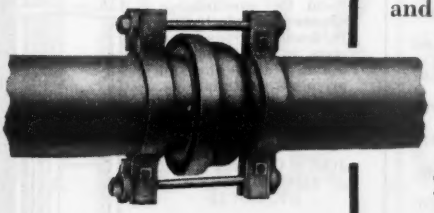
SPECIFY *American* or *Niagara*
(BRONZE CASE) (IRON CASE)
Water Meters
WRITE FOR CATALOG

BUFFALO METER COMPANY
Established 1892 2914 Main St., Buffalo, N. Y.









Eliminate Expensive Leaks

No expensive explorations, no digging for leaks after pipe is laid — Grinnell Socket Clamps provide simple, sure safeguards against costly leaks —they strengthen joints, prevent leaks.

All clamps and rods are protected with durable coal tar pitch varnish. For quick and secure installation, Grinnell Socket Bends are provided with convenient lugs. Grinnell Steel Socket Clamps are available in a wide range of sizes and lengths—Friction and Positive Types — to handle any joint and any size of fittings. Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

SOCKET FITTINGS BY

GRINNELL

...WHENEVER PIPING IS INVOLVED...

(*Continued from page 18*)

funds for the payment of water works obligations should be increased—no matter what theory may be held as to the basis of equitable rates.

"It is the consensus of water men that municipal water departments should be placed on a business basis. They should be self-supporting and their rates should be reasonable," said Mr. Black. "Further, water revenue should not be diverted and used to supplant general taxation."

If the water meter inspector called with a clothespin over his nose, the average housewife would probably be surprised.

But that is virtually what took place for the 14 long years of prohibition, and still is being done in the case of those families that have not yet been weaned away from their home-brew. Water officials generally refused to allow the noses of meter inspectors to function while in the cellars of home-brewers, despite the strong pressure of prohibition authorities to obtain information of violations from that source.

But water men, while closing their noses to the odorous fumes of fermenting liquor, are using their noses effectively in the interests of their customers. In many cities men, who refused to become "cellar smellers,"

(*Continued on page 22*)

HELLIGE
AQUA TESTER

Most convenient comparator for accurate analysis using Standard Methods published by Amer. Public Health Ass'n and Amer. Water Works Ass'n. Glass standards are available for these tests: Color of Water, Ammonia Nitrogen, Nitrite Nitrogen, Chlorine, Total Iron, and Dissolved Oxygen.

Write for Bulletin No. 612

HELLIGE, INC.
3718 NORTHERN BLVD.
LONG ISLAND CITY, N. Y.

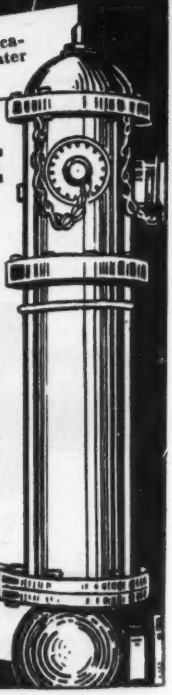
Complying with the Specifications of the American Water Works Ass'n.

KUPFERLE
Fire
Hydrants

Send for specification sheets of Kupferle Fire Hydrants; types and sizes to meet requirements of all public and private installations. Backed by a half century of proven performance.

JOHN C. KUPFERLE
FOUNDRY CO.
ST. LOUIS

NO. 100. Tested and Approved by National Board of Fire Underwriters.



HERSEY
WATER METERS

have been Preëminent among Water Work Men for more than 50 years

HERSEY MANUFACTURING COMPANY—SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK – PORTLAND, ORE. – PHILADELPHIA – ATLANTA
DALLAS – CHICAGO – SAN FRANCISCO – LOS ANGELES

(*Continued from page 20*)

have turned into "water smellers." During the past decade municipal water officials, in order to give the public water of better quality, have adopted the practice of carefully checking the tastes and odors in the water supply. This is accomplished by smelling the water, usually after heating. With a little practice it is possible to detect quickly undesirable tastes and odors which impair palatability. More than 1,000 cities in the United States now have "water smellers" who regularly check the quality of water being delivered to taxpayers. Most of the objectionable disflavors are removed by activated carbon, a substance first used for water purification only about 10 years ago. A "water smeller" determines the amount of activated carbon needed at any particular time.

The widespread use of activated carbon is cited as an example of the efforts of municipal water officials to improve the quality of city water. About 25 years ago the use of chlorine to sterilize water became widespread. Having learned how to make water safe, the water men turned their efforts to make it more palatable, with the result that the quality of water in the United States is far above that of other countries.

(*Continued on page 26*)

80% Saving

in fire hydrant collision repair costs

IMPACTS that would demolish any other type of fire hydrant merely fracture the inexpensive Safety Breakable Section of the Kennedy SAFE-TOP Fire Hydrant without injury to the major parts of the hydrant. The water pressure in the main keeps the inlet valve tightly closed so that there is no danger of flooding. No excavating is necessary, nor need the water service be shut off while awaiting or making repairs.

The only parts that need be renewed cost $6.00. They can be replaced by one man, with standard tools, in less than half an hour.

Write for Bulletin

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY SAFETOP FIRE HYDRANT

REG. U.S. PAT. OFF.

MORRIS KNOWLES, INC.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.
Pittsburgh, Pa.

ALEXANDER POTTER
Consulting Engineer
Specialties: Water Supply and Sewerage
50 Church St. New York City
Telephone 5501 Cortlandt

METCALF & EDDY
Engineers
Charles W. Sherman, Almon L. Fales, Frank A. Marston, John P. Wentworth, Harrison P. Eddy, Jr., Arthur L. Shaw, E. Sherman Chase
Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories Valuations
Boston, Mass. Statler Building **Harrisburg, Pa. Telegraph Building**

CLYDE POTTS
M. Am. Soc. C. E.
Consulting Sanitary Engineer
30 Church Street - - New York
Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

REEVES NEWSOM
Engineer - Consultant
Supply, Purification and Distribution of Water
Operation Design Construction
Valuation Rates Negotiations
Investigations Taxes Accounting
500 Fifth Avenue New York City

SCOFIELD ENGINEERING CO.
Consulting Engineers
Water, Gas, Electric Plants and Distribution Systems
Appraisals, Valuations and Reports
Design—Supervision—Operation
Philadelphia, Penna.

PEASE LABORATORIES, INC.
39 West 38th Street, New York
Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.
Chemists Field Sanitary Surveys
Bacteriologists Consultants

WESTON & SAMPSON
Robert Spurr Weston G. A. Sampson
Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.
14 Beacon St. Boston, Mass.

MALCOLM PIRNIE
Engineer
Water Supply, Treatment, Sewerage,
Reports, Plans, Estimates,
Supervision and Operation
Valuation and Rates.
25 W. 43rd St., New York, N. Y.

WHITMAN, REQUARDT AND SMITH, *Engineers*
Ezra B. Whitman, Gustav J. Requardt, Benjamin L. Smith, Norman D. Kenney, Robert T. Regester, Theodore W. Hacker
WATER WORKS - SEWERAGE - UTILITIES
Baltimore, Md. Albany, N. Y.

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings
50 Church St. New York City

Help Build up Your Association by Bringing in a New Member
SEND FOR APPLICATION BLANK
AMERICAN WATER WORKS ASSOCIATION
22 East 40th St. NEW YORK CITY

(*Continued from page 22*)

Increasing use of water in American cities requires careful study to prevent waste and to enable proper planning to maintain adequate service, especially during seasonal peaks of use, according to O. C. Holleran, Chief, Industrial Marketing Unit, U. S. Department of Commerce. In 1936, of 434 cities which reported to the unit, 388 had increases in consumption, varying from 1 to 50 per cent over the previous year.

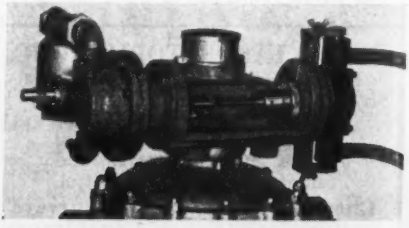
Greater industrial activity accounted for a substantial part of the increased consumption in some reporting cities. Rapid development of air conditioning, requiring large quantities of water, has resulted in heavy demands on many municipal water works. During the peak season demand, 10 per cent or more of the water consumed in some cities is used for air conditioning. However, use of water-conserving equipment is increasing, and future growth in water use may not be as rapid as in the past. A number of cities reported that demand for water now approaches the full capacity of their equipment. A few cities reported that sewers are near their peak capacity.

(*Continued on page 28*)

When you choose hydrants, be sure they deliver full flow at all times—eliminate surge and water hammer—break off above the ground, and can be replaced without digging.

Ludlow Hydrants do all that, and combine graceful design with low maintenance costs as well. Send for free folder.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK



It makes NO difference to % PROPORTIONEERS % What water meter is YOUR favorite—

NEPTUNE
HERSEY
WORTHINGTON
NATIONAL
NIAGARA
PITTSBURGH
UNION
SPARKLING
FLOW-OM-ETER
OR
VENTURI

We can show successful installations of every one of these meters controlling our "Little Red Pumps"!

Write for Bulletin "RED"

Proportioneers, Inc.
18 Codding Street
Providence, R. I.

MATHIESON CHLORINE SERVES LINCOLN SEWAGE PLANT

Says Wardner G. Scott, Engineer, Sanitary District Number One of Lancaster County, Nebraska:

"The quality of Mathieson Liquid Chlorine, together with the prompt service on shipments has been entirely satisfactory at all times."

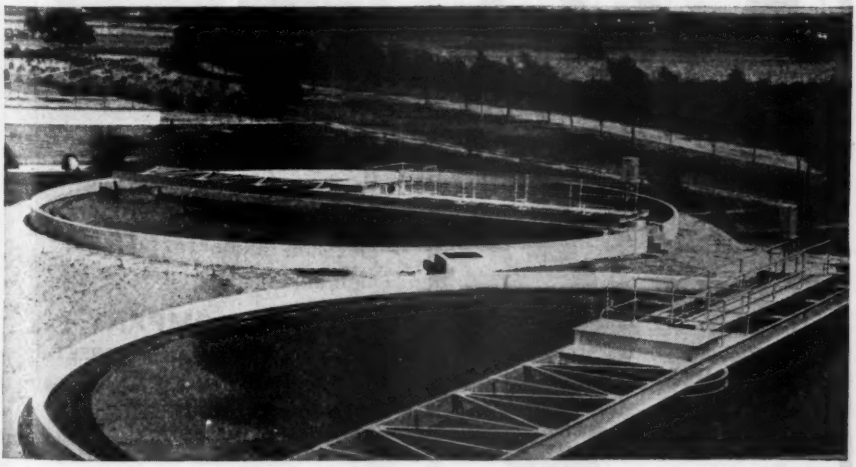
ABOVE all else, whether the job in hand be water purification, sewage treatment or swimming pool sanitation, your supply of liquid chlorine must be dependable. You have a right to expect at all times a pure product, trouble-free containers and valves, prompt delivery service.

At Lincoln, Nebraska, where the sewage treatment plant uses chlorine in ton containers, Mathieson Liquid Chlorine has been proving its dependability over a period of years. As Mr. Scott states, he has found the quality of the product and the prompt service on shipments entirely satisfactory at all times.

Because so many sanitary officials have had the same experience as Mr. Scott, they have learned to specify Mathieson whenever there is a chlorinating job to be done.

The MATHIESON ALKALI WORKS (Inc.)
60 East 42nd Street New York, N. Y.

Soda Ash . . . Liquid Chlorine . . . Bicarbonate of Soda . . HTH and HTH-15 . . . Caustic Soda . . . Bleaching Powder . . . Ammonia, Anhydrous and Aqua . . . PH-Plus (Fused Alkali) . . . Dry Ice (Carbon Dioxide Ice)



(*Continued from page 26*)

Because of the increasing consumption of water, and extensive waste of unmetered water, Mr. Holleran recommends that every city make a careful study of its water consumption. Many cities have reduced waste through the complete metering of water. One city cut down the use of water by 38 percent by metering water to all users. Accurate records also should be kept of the amounts of water supplied to schools and to the street and other departments, he urged. If such records are not kept, water officials can only guess where their product goes. Expansion in demand may find a city unprepared to meet it.

"The problem of water supply may be expected to grow steadily in importance," said Mr. Holleran. "With every passing year, our annual increases in population, especially in the already densely peopled sections of the country, the concentration and growth of industry, and the modernization of both industrial and residential equipment, points to an equally constant increase in water demand. The free use of water (by other municipal departments) and the unnecessary wastage of water must sooner or later be checked simply because of limitations on sources of supply. By keeping adequate records and accumulating a thorough knowledge of

(*Continued on page 30*)

LOOK FOR THE

K-CO

TRADE MARK

C-101 Roundway Stop For Iron Pipe Tee Handle

C-167 Curb Stop Inverted Key Roundway For Iron Pipe

Write for catalog and price list.

C-129 Corporation Stop Quarter or 90° Coupling Lead Pipe Connection

It identifies every Kitson Product. It is your guarantee of a quality product precision made to uniform, high standards.

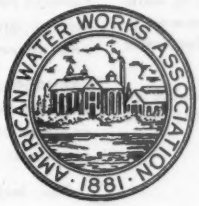
KITSON COMPANY

2409-15 WESTMORELAND STREET

PHILADELPHIA, PA.

Manufacturers of: Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters . . . Quality Brass Goods for Gas, Water and All Plumbing Uses.

BADGE THE AMERICAN WATER WORKS ASSOCIATION

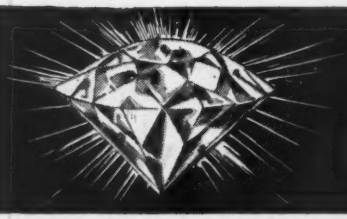


This cut is a facsimile, enlarged, of the official badge or emblem of the association. It is of gold and blue enamel made with a pin, but can be made into a button or watch charm.

The price of the badge in solid gold is $5.00 and it can be procured by addressing

AMERICAN WATER WORKS ASSOCIATION
22 East 40th Street, New York, N. Y.

These badges are not to be confused with the usual convention badge, but are for everyday use



CARBON
In Its Highest Form

But Valueless for Water Purification

Although the diamond is carbon in its most valuable form, it is worthless compared to CLIFFCHAR ACTIVATED CARBON for water purification.

Leading municipalities place high value on CLIFFCHAR to remove objectionable taste and odors from water supply.

CLIFFCHAR "R"
Special Grade for Water Purification

Low phenol value, shown by standard phenol tests, gives high ability to remove phenolic and similar compounds.

Extreme fineness (99% passing a 325 mesh screen) gives maximum surface exposure and adsorptive capacity.

Controlled, uniform density assures sufficient suspension period to take full advantage of its high adsorptive ability, yet settle out in ordinary settling basins.

The technical and laboratory facilities of this company are available without obligation to those concerned with taste and odor problems in water purification. Your inquiry is invited.

Cliffs Dow

CLIFFS DOW CHEMICAL COMPANY, Marquette, Michigan
Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Sts., St. Louis; Field Bldg., Chicago

(*Continued from page 28*)

every question involved in use and disposal of the public water supply now, authorities will be able when the time comes to insure a safe and equitable control of the problem instead of being forced, when an emergency arises, to depend upon recommendations hurriedly made and, therefore, liable to create conditions even more serious than those they are expected to correct."

During the past decade an average of more than $150,000,000 annually has been spent by American cities in extension and improvement of water works facilities. Needed construction projects during the next few years are estimated to total more than one billion dollars. Many cities, especially in the eastern part of the country north of the Mason-Dixon line, will soon be in urgent need of greater water facilities. New York City plans to spend approximately one-quarter of a billion dollars during the next decade to obtain more than 400,000 gallons daily from the Delaware River. Expanding population and industrial development of northern New Jersey may soon force municipalities in that area to reach out for additional supplies.

(*Continued on page 36*)

APPLICATION FOR MEMBERSHIP
IN THE
AMERICAN WATER WORKS ASSOCIATION
22 East 40th Street, New York, N. Y.

Date:.....

....hereby make application for
(I or We)

.....
(Active, Junior, Corporate or Associate Membership, or Affiliate)

in the American Water Works Association, and enclose herewith the sum of $....., one year's dues in advance.

Name.....

Company or Department.....

Title or Position.....

Address.....

.....

If application is for Junior Membership, give date of birth.....

If application is for Affiliate, state number of active services in property where employed .....

Nature of business or character of work (for office records).....

.....

.....

.....

.....

.....

.....

.....

.....

If application is for Corporate or Associate Membership, it must be signed by the person designated to represent the firm or corporation in A.W.W.A. activities.

.....
Signature of Applicant

(over)

ARTICLE I OF BY-LAWS

Section 3. An Active Member shall be a superintendent, a manager, an official or employee of a municipal or private water works; a civil, mechanical hydraulic, or sanitary engineer, a chemist, a bacteriologist, or any qualified person engaged or interested in the advancement of knowledge relating to water supplies. (Annual Dues, $10.00.)

Section 4. A Corporate Member shall be a Water Board, Water Commission, Water Department, Water Company or Corporation, National, State or District Board of Health, or other body, corporation or organization engaged or interested in water supply work, and shall be entitled to one representative whose name shall appear on the roll of members, and who shall have all the rights and privileges of an Active Member. This representative may be changed at the convenience and pleasure of the Corporate Member on written notice to the Secretary. (Annual Dues, $15.00.)

Section 5. An Associate Member shall be either a person, firm or corporation engaged in manufacturing or furnishing supplies for the operation, construction, or maintenance of water works. (Annual Dues, $25.00.)

Section 6. A Junior Member shall be an employee of a municipal or private water works; a civil, mechanical, hydraulic, or sanitary engineer, a chemist, a bacteriologist, a student or any otherwise qualified person engaged or interested in the advancement of knowledge relating to water supplies. At the time of his admission he shall be not less than eighteen years of age. His connection with the Association shall cease when he becomes twenty-five years of age, unless he is regularly enrolled as a student in a university or has previously transferred to the grade of Active Member. Junior Members shall receive the Journal and all privileges of Active membership except holding office and voting. (Annual Dues, $5.00.)

Section 7. An affiliate shall be any person otherwise qualified for Active membership who, at the time of application, is not nor previously has been a member of the Association and who, for acceptable reasons, does not wish to become an Active Member.

No corporation, firm or partnership which otherwise would be entitled to the grades of Associate or Corporate member may hold the grade of Affiliate. No employee of an Associate member may become an Affiliate. No person who is the superintendent, the manager, the chief engineer, the superintendent of filtration, the chief chemist, or the superintendent of distribution in a plant having more than 3,000 active services, is eligible for the grade of Affiliate. Under unusual conditions, exception to the above may be made by action of the Executive Committee if the applicant sets forth fully the reasons for the exception when applying for the Affiliate grade.

Affiliates shall not be entitled to vote upon general Association questions, and not eligible to hold office in the Association, nor in any of its Divisions. They shall be eligible to vote upon Section questions and to hold Section offices except those of Chairman, Vice-Chairman, Secretary (and/or Treasurer). They shall be entitled to all other rights and privileges of Active Members. Affiliates receive the March, June, September and December issues of the Journal each year. (Annual Dues, $4.00.)

Memberships will be dated as of the beginning of the quarter in which the application is received.

Membership in the Association carries, also with no additional dues, membership in its Local Sections and National Divisions, and includes the Journal, a monthly publication devoted to water works interest. The proceedings of the annual conventions and of the meetings of the Local Sections are published in the Journal, which also contains contributed articles on subjects pertaining to public water supplies.

A COMMUNITY ISOLATED BY

FLOOD WATERS

...BUT ITS WATER SUPPLY IS SAFE

FREE—

NEW BOOKLET

Covers the many uses of Perchloron. Gives full data on emergency feeding, determination of residual chlorine, preparing Perchloron solutions, and many other interesting points.

IN TIME of emergency, some communities have found themselves temporarily unable to obtain normal water purification supplies. But with wise foresight, many have provided themselves with a secondary line of defense—a supply of Perchloron for use at just such times.

Perchloron has an available chlorine content of more than 70%. It is concentrated, stable, perfectly uniform. Dissolves readily in water. Packed 12 handy-sized cans to the case — no return containers to bother you.

Under normal conditions also, you will find Perchloron an economical convenience. Use it for sterilizing new mains, and for clear wells and filters. It has been widely adopted for swimming pool sanitation, and has earned a place in sewage treatment. Why not write for new, free booklet today?

PENNSYLVANIA SALT MANUFACTURING COMPANY • Est. 1850
Widener Bldg., Philadelphia, Pa.
New York • Chicago • St. Louis • Pittsburgh • Tacoma Wyandotte

PENNSYLVANIA SALT *Chemicals*

(*Continued from page 30*)

Unlike most other municipal activities, the supplying of water to the public is a self-supporting undertaking. A properly planned and operated water department pays for itself and the investment in such a project is self-liquidating. For that reason cities should not hesitate to plan for the future needs of their communities. Good water makes satisfied citizens, enhances realty values, and attracts industries to a municipality.

Besides the large cities which must expand their water facilities during the next few years, this association calls attention to the need of small villages and towns for improvement of their water supplies. More than 10,000,000 persons live in communities of less than 5,000 population, and many of those communities depend still upon wells and cisterns to furnish water of doubtful quality. The excessive typhoid death rates in some sections of the South may result, it is believed, from lack of adequate water facilities in small communities.

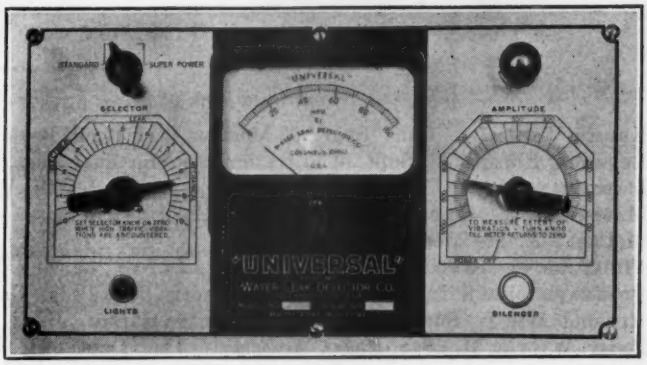
Oklahoma City is adding mechanical lime-handling equipment to its purification plant structures and repainting two elevated tanks. So reports Frank Hermann, Office and Designing Engineer of the Water Department.

Ernest B. Bain, who was Superintendent of the Raleigh, N. C., Water Department for 36 years prior to July, 1933, has been reappointed to that position by Ray L. Williamson, Commissioner of Public Works of that city.

The Pennsylvania Water Works Operators Association will hold its annual meeting at State College, Pa., on June 7th and 8th.

"UNIVERSAL METHOD" OF WATER LEAK SURVEY

WITH YOUR OWN MEN



SUPER-POWER PANEL

You can eliminate guess work entirely with the "UNIVERSAL" Measured Sound Method. Visual amplitude recording eliminates mistakes caused by the failings of the human ear. And having located the leak, by a simple process its approximate size can be determined in advance of excavation.

You owe it to your city to modernize your water department with "UNIVERSAL" Water Leak Survey instruments. Make your own survey at the minimum of cost to fit your own particular need.

The "UNIVERSAL" Super-Power (Converter type) instrument (shown below) is built to enable the water leak survey engineer to detect VERY SMALL LEAKS at long distances through hydrants and valves, and also to locate these small leaks under the pavement.

We will furnish an experienced instructor upon request to train your men. The time and cost involved may well be repaid within the first week.

This same instrument, with extra attachments, will locate your buried pipe lines.

Demonstrations given upon request and without any obligation.

"UNIVERSAL" COMPLETE WITH PIPE LOCATING ATTACHMENTS

WATER LEAK DETECTOR CO.

155 N. THIRD ST. COLUMBUS, OHIO

BRANCH OFFICES:

142 Ashland Place, Brooklyn, N. Y.
1403 Oliver Building, Pittsburgh, Pa.
419 Smith Tower, Seattle, Wash.
J. Van Benschoten,
58 Pelham Ave.,
Toronto, Ontario, Canada

Trade Mark MABBS Reg. U. S. Pat. Off.

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

(Continued from page vi)

KRUMM, TAHLMAN. Cons. Engr., 65 Meadow Park Road, Bexley, Columbus, O.
LEVEQUE, ROLAND J. Supt. of Filtration, 809 Mortimer Ave., Fredericksburg, Va.
MARCKMANN, O. W. Water Works Dept., Crane Co., Seattle, Wash.
MASTIN, M. G. Chief Chemist, Westvaco Chlorine Products Corp., Newark, Calif.
McLEAN, E. P. Moultrie, Ga.
PIRIE, JAS. C. Sales Engr., 107 S. Pennsylvania Ave., Lansing, Mich.
PUCKHABER, FRED H. Sales Engr., 1119 Liberty Bank Bldg., Dallas, Tex.
RUSSELL, WM. J. Supt. of Water Dept., Benton Harbor, Mich.
SCOTT, WALTER M. San. Engr., Westchester Co., Dept. of Health, Mount Vernon, N. Y.
SHANLEY, A. A. Mgr., Crane Co., P.O. Box 751, Great Falls, Mont.
SHEA, JOHN J. Supt. of Public Works, Frankfort, N. Y.
SHUFF, EVANS L. Engr. & Sales Agency, 724 First Natl. Bank Bldg., Atlanta, Ga.
SIMMONS, FRANK. Supt. Water Works, Russellville, Kentucky.
STEWART, C. W., JR. Rep. of Darling Valve & Mfg. Co., c/o Lincoln Hotel, Indianapolis, Ind.
STEWART, O. J. Supt. of Water Works Dept., Greencastle, Indiana.
THOMPSON, ALBERT. Meter Shop Foreman, Minneapolis Water Dept., 3516 South 47 Avenue, Minneapolis, Minn.
THORNE, L. H. Vice-Pres. & Treas., W. L. Thorne Co., 1203 Thacker St., Des Plaines, Ill.
WALL, GEORGE ALBERT. Engineering Draftsman, Los Angeles Athletic Club, 431 West 7th St., Los Angeles, Calif.

Reinstatements, March 1 to 31, 1938

ECKERT, ALFRED. Director of Public Works, 3 Jefferson Court, Saginaw, Mich.
FINCH, LEWIS S. Civil Engr., 276 Century Bldg., Indianapolis, Ind.
MOORE, RUSSELL B. Cons. Engr., K. P. Bldg., Indianapolis, Ind.
TVARGOSKY, P. A. City Water Works Vicksburg, Miss.

Transfers between Sections

LENERT, LOUVA G. From New York to Southeastern.
HOFFER, H. A. Four States to New Jersey.
OCKERSHAUSEN, RICHARD W. New York to Illinois.
DUNSTAN, GILBERT H. Missouri Valley to Southeastern.
WERTZ, C. F. Four States to New York.
LINDERMAN, S. E. Four States to Central States.
KIRKPATRICK, JOHN W. Indiana to Michigan.
MOORE, C. HERBERT. Illinois to New York.
BRUNE, FRED H. California to Illinois.
SANCHIS, JOSEPH M. California to South America.

Valuable and Instructive Publications Prepared and Distributed

By THE AMERICAN WATER WORKS ASSOCIATION

22 East 40th Street, New York, N. Y.

Manual of Water Works Practice

This book is the coördinated effort of 300 specialists and presents their accurate summaries of modern water works practice. It discusses collection, distribution, treatment and consumption of water supplies, contains accepted specifications, and treats of water supply problems in relation to the health, safety and welfare of the public.

Cloth, gold stamped, 814 pages, illustrated, price $5.00, postpaid. (First Edition, September, 1925—Reprinted September, 1926, and May 1929.)

Index to the Proceedings, Journal and Other Publications of The American Water Works Association from the Founding of the Organization. 1881-1933

This book opens the door to an immense store of knowledge covering studies, problems and experiences of hundreds of water works superintendents, engineers, scientific specialists, etc., during the past fifty-three years.

It is well bound in buckram, with stiff covers, and contains 233 pages. The price is $1.50 per copy to members and $2.50 per copy to non-members, postpaid.

Census of Municipal Water Purification Plants in the United States, 1930-1931

A paper-covered book of 146 pages at fifty cents per copy, postpaid.

...*"And dripping with coolness, it rose from the well."**

THE clear, cool water that flows from the modern water faucet may never be a subject for romance, but it *is safe*!

Today, water-borne diseases have been reduced almost to a minimum. The story of this accomplishment with its saving of lives by the millions—is one of the great achievements of the ages.

Eternal vigilance on the part of water-works men and those who supply chemicals for treating water supplies is essential in order to maintain today's accepted high standards of water purification and sanitation methods.

As its contribution to maintaining these high standards, the General Chemical Company supplies water-works and sewage disposal plants with chemicals that are manufactured only under the most rigid control. Its products are unfailingly uniform with respect to chemical and physical composition . . . can *always* be relied upon by water-works and sanitation engineers.

(* *"The Old Oaken Bucket," by Samuel Woodworth*)

GENERAL CHEMICAL COMPANY

Write for information on

Aluminum Sulfate · Ferrous Sulfate · Ferric Chloride · Crystal Alum Ammonium · Crystal Alum Potassium · Copper Sulfate Sodium Metasilicate · Aqua Ammonia · Monosodium Phosphate Sodium Bisulfite, Anhydrous Glauber's Salt, Crystal or Anhydrous · Phosphoric Acid · Trisodium Phosphate · Sodium Hyposulfite · Sodium Silicate · Disodium Phosphate.

GENERAL CHEMICAL COMPANY

Executive Offices:

40 Rector Street **New York, N. Y.**

Sales Offices: Atlanta • Baltimore • Buffalo • Camden (N. J.) • Charlotte (N. C.) • Chicago • Cleveland • Denver • Houston • Los Angeles • Medford (Mass.) • Milwaukee • Minneapolis • Pittsburgh Providence (R. I.) • San Francisco • St. Louis • Utica (N. Y.) Wenatchee (Wash.) • Yakima (Wash.)

In Canada: The Nichols Chemical Company, Limited Montreal • Toronto

WORTHINGTON
EQUIPMENT FOR WATER SUPPLY

CENTRIFUGAL PUMPS — STEAM AND POWER PUMPS

DEEP WELL TURBINE PUMPS — SUMP AND DRAINAGE PUMPS

DIESEL ENGINES — GAS ENGINES

STEAM CONDENSERS — CONDENSER AUXILIARIES

FEEDWATER HEATERS — STEAM-JET EJECTORS

STATIONARY AIR COMPRESSORS — PORTABLE AIR COMPRESSORS

ROCK DRILLING EQUIPMENT — CONSTRUCTION AIR TOOLS

V-BELT DRIVES — AIR LIFTS

STEAM TURBINES

●

WATER METERS

A complete line of water meters of every type is manufactured by Worthington-Gamon Meter Company, a subsidiary of Worthington Pump and Machinery Corporation.

● ***Descriptive literature on any of these products furnished on request***

WORTHINGTON PUMP AND MACHINERY CORPORATION
WORTHINGTON-GAMON METER COMPANY

General Offices: HARRISON, NEW JERSEY — District Offices and Representatives in Principal Cities

CDS-7

STRENGTH

+ EASY INSTALLATION

+ ADAPTABILITY

+ SAFETY

+ HIGH INITIAL AND PERMANENT CARRYING CAPACITY

+ WATER TIGHTNESS

+ NO ELECTROLYSIS

+ NO TUBERCULATION

+ LONG LIFE

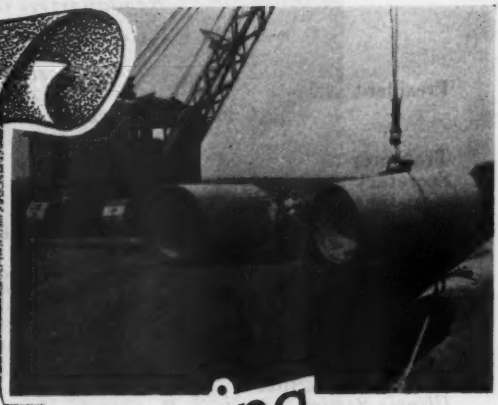
+ LOW FIRST COST

+ LOW MAINTENANCE

+ LOW OPERATING COST

ANSWER=

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE



Summing It All Up!

THERE are certain Essential Qualities which every good Pressure Pipe Line should have. These qualifications are listed at the left.

If a pipe line can conform to all these requirements, a practical guarantee of Uninterrupted, Permanent Service is assured.

All of these Essential Qualities exist in every Lock Joint Reinforced Concrete Pressure Pipe Line now in service.

Why not investigate?

LOCK JOINT PIPE CO.
Est. 1905. Ampere, N. J.
Pressure : Sewer
Culvert : Subaqueous

AMERICAN WATER WORKS ASSOCIATION

Headquarters Office

22 East 40th St., New York

Officers

President — REEVES NEWSOM
Consulting Engineer, 500 Fifth Avenue
New York, N. Y

Treasurer — WILLIAM W. BRUSH
Secretary — HARRY E. JORDAN
Assistant Secretary — P. S. WILSON

Board of Directors

Representing the Local Sections

California Section	NELSON A. ECKART, San Francisco, Cal.	to-1939
Canadian Section	ALBERT E. BERRY, Toronto, Ont.	-1940
Central States Section	H. LLOYD NELSON, Philadelphia, Penna.	-1941
Florida Section	A. P. BLACK, Gainesville, Fla.	-1939
Four States Section	CHARLES H. BECKER, Philadelphia, Pa.	-1939
Illinois Section	HAROLD E. BABBITT, Urbana, Ill.	-1939
Indiana Section	H. A. DILL, Richmond, Ind.	-1940
Kentucky-Tennessee Sect.	E. E. JACOBSON, Lexington, Ky.	-1941
Michigan Section	GEORGE H. FENKELL, Detroit, Mich.	-1941
Minnesota Section	LEONARD N. THOMPSON, St. Paul, Minn.	-1939
Missouri Valley Section	EARLE L. WATERMAN, Iowa City, Iowa	-1941
Montana Section	JOSEPH M. SCHMIT, Lewistown, Mont.	-1939
New England Section	ROGER W. ESTY, Danvers, Mass.	-1941
New Jersey Section	SAMUEL F. NEWKIRK, Elizabeth, N. J.	-1941
New York Section	WILLIAM A. MCCAFFREY, Oswego, N. Y.	-1941
North Carolina Section	PAUL W. FRISK, Enka, N. C.	-1940
Pacific Northwest Sect.	MILTON H. MCGUIRE, McMinnville, Oregon	-1941
Rocky Mountain Section	CHESTER A. TRUMAN, Colo. Sprgs., Colo.	-1940
Southeastern Section	J. K. MARQUIS, Spartanburg, S. C.	-1940
Southwest Section	JOHN B. WINDER, Dallas, Texas.	-1939
Virginia Section	MARSDEN C. SMITH, Richmond, Va.	-1940
Wisconsin Section	ARTHUR H. MILLER, Sheboygan, Wis.	-1940

Representing the Water Works Manufacturers Association

Manufacturer	DENIS F. O'BRIEN, East Orange, N. J.	-1939
Manufacturer	WILLARD T. CHEVALIER, New York, N. Y.	-1940
Manufacturer	CLINTON INGLEE, New York, N. Y.	-1941

Ex-Officio Members of the Board

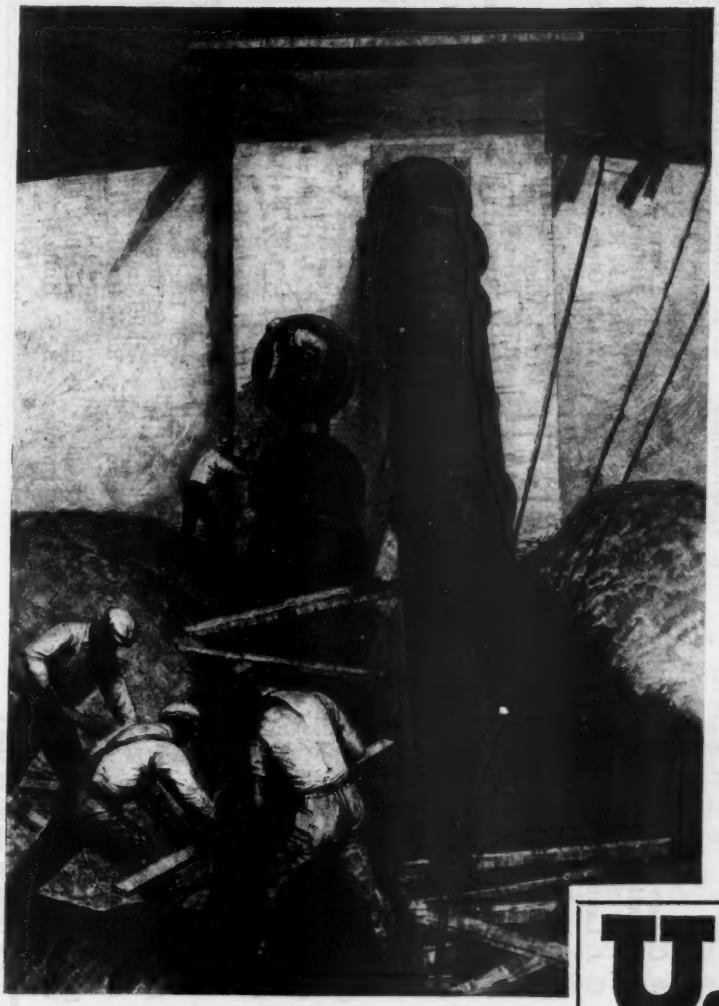
President	REEVES NEWSOM, New York, N. Y.	-1940
Past President	EUGENE F. DUGGER, Newport News, Va.	-1939
Treasurer	WILLIAM W. BRUSH, New York, N. Y.	-1939
Ch. W. W. Practice Comm.	MALCOLM PIRNIE, New York, N. Y.	-1939
Ch. Publication Comm.	LINN H. ENSLOW, New York, N. Y.	-1939

Officers of the Divisions

Finance and Accounting Division.—Chairman, M. F. HOFFMAN; Vice-Chairman, DALE L. MAFFITT; Secretary-Treasurer, WILLIAM J. SCHWARTZ; Directors, JACOB SCHWARTZ, HAL F. SMITH.

Plant Management and Operation Division.—Chairman, THOMAS L. AMISS; Vice-Chairman, A. P. KURANZ; Secretary-Treasurer, D. D. GROSS; Directors, SAMUEL F. NEWKIRK, L. S. VANCE.

Water Purification Division.—Chairman, CHARLES GILMAN HYDE; Vice-Chairman, CHARLES H. SPAULDING; Secretary-Treasurer, CHARLES R. COX; Additional members of Executive Committee, M. C. SMITH, PAUL WEIR.



Lithographed on stone by James E. Allen for U. S. Pipe & Foundry Co., Copyright 1937, U. S. Pipe & Foundry Co.

U.S. cast iron PIPE

Cast iron pipe centrifugally or pit cast—for water works, gas, sewerage and drainage service as well as industrial uses involving corrosives.

U. S. Pipe & Foundry Co.
BURLINGTON, N. J.

Foundries and Sales Offices throughout the U. S.

ADVANTAGES enjoyed by purchasers of U. S. Pipe are the *plus-services* made possible by strategically-located plants and storage yards; by complete and modern laboratory facilities; and by an expert technical staff. Co-operation in pipe design for unusual requirements, and strict adherence to exacting delivery schedules, can be counted on. We are organized and equipped to render a complete service in long-lived Cast Iron Pipe, either pit or centrifugally cast, for delivery anywhere.

Officers of the Sections

Section	*Chairman*	*Vice-Chairman*	*Secretary-Treasurer*	*Past-Chairman*	*Other Members of the Section Governing Board*[2]
California	J. E. Phillips	H. Reinhardt	C. M. Hoskinson	R. F. Brown	J. R. Barker, G. W. Hawley, J. S. Longwell, F. S. Porter, C. Wilson.
Canadian	A. B. Manson	—	A. E. Berry	E. V. Buchanan	C. E. Brown, L. G. McNeice, R. J. Smith, G. H. Strickland, F. G. Browne, W. Storrie, W. T. Randall.
Central States	E. C. Trax	W. C. Lawrence	E. P. Johnson	R. Hulbert	T. L. Young, E. A. Johnson.
Florida	T. M.Lowe	G. F. Catlett	J. R. Hoy	D. S. Wallace	R. G. Ridgely, G. Kingsley, K. R. Chinn, F. R. Mills, W. B. Gibson
Four States	H. M. Freeburn	C. J. Lauter	C. A. Hechmer	E. B. Whitman	I. M. Glace, G. R. Taylor, E. S. Hopkins, A. Wolman.
Illinois	W. D. Gerber	F. G. Gordon	C. W. Klassen	F. C. Amsbary	G. B. Prindle, H. H. Gerstein.
Indiana	P. C. Laux	M. H. Schwartz	J. A. Bruhn	J. L. Ford	C. L. Link.
Kentucky-Tenn.	C. M. McCord	H. Arnold	H. D. Schmidt	E. E. Jacobson	H. C. Bristol, H. N. Jernigan.
Michigan	E. E. Norman	C. R. Bird	M. N. Gerardy	—	O. A. McCarthy, L. E. McQueen, R. J. Faust.
Minnesota	F. Seligman	J. A. Jensen	R. M. Finch	R. A. Thuma	E. M. Grime, A. C. Janzig, C. L. Elliott.
Missouri Valley	D. L. Maffitt	B. L. Ulrich	E. L. Waterman	N. T. Veatch	C. Alexander, C. Hoen, E. R. Mathews, L. M. Nelson, F. A. Rathert.
Montana	G. E. Atkinson	C. W. Eyer	H. B. Foote	R. N. Arnold	D. S. Thomas, Kurt Wiel
New England	S. S. Anthony	F. A. Marston	S. M. Ellsworth	W. J. Scott	H. W. Griswold, P. A. Shaw.
New Jersey	W. R. Conard	G. F. Wieghardt	H. N. Lendall	S. F. Newkirk	J. A. Carr, C. H. Capen.
New York	E. L. H. Meyer	F. Henshaw	R. K. Blanchard	A. D. Drake	C. R. Cox, E. K. Wilson.
North Carolina	J. W. Kellogg	R. A. Thomas	A. R. Hollett	H. G. Baity	
Pacif. Northwest	N. A. Gilman	T. H. Judd	F. Merryfield	M. H. McGuire	R. E. Koon, M. K. Snyder
Rocky Mountain	O. J. Ripple	—	B. V. Howe	P. S. Fox	K. W. Caldwell, O. B. Summers, B. G. Coy, J. P. Soderstrum, K. F. Darling, L. O. Williams.
Southeastern	C. P. Townsend	P. Weir	B. P. Rice	D. R. Pringle	F. G. Crow, M. G. Stewart, J. H. McLure, H. F. Wiedeman
Southwest	T. L. Amiss	A. R. Davis	L. A. Quigley	H. E. Nunn	R. W. Harding, L. A. Jackson, A. F. Theard, M. T. Vanlandingham.
Virginia	H. B. Rice	H. A. Johnson	H. W. Snidow[1]	A. L. Meisel	E. C. Meredith,[1] C. L. Crockett.
Wisconsin	W. U. Gallaher	W. C. Staeffler	L. A. Smith	C. Gruetzmacher	A. E. Hintz.

[1] Virginia Section—Secretary is H. W. Snidow; Treasurer E. C. Meredith
[2] For Section's representative on the A. W. W. A. Board of Directors, see list on page ii

COMING MEETINGS

Aug. 17–19—Central States Section, at Hotel Windsor, Wheeling, West Virginia. Secretary, E. P. Johnson, 418 Flannery Bldg., Sta. 13, Pittsburgh, Pa.

Aug. 25–26—Virginia Section, at Hotel Robert E. Lee, Lexington, Va. Secretary, H. W. Snidow, State Dept. of Health, Richmond, Va.

Sept. 12–13—Rocky Mountain Section, at Townsend Hotel, Casper, Wyoming. Secretary, B. V. Howe, State Office Building, Denver, Colo.

Sept. 15–16—New England Water Works Association, at Hotel Statler, Boston, Mass. Secretary, Frank J. Gifford, Statler Building, Boston, Mass.

Sept. 14–16—Michigan Section, at Bancroft Hotel, Saginaw, Mich. Secretary, M. N. Gerardy, Water Board Bldg., Detroit, Mich.

Sept. 22–23—New York Section, at Nelson House, Poughkeepsie, N. Y. Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

Sept. 29–Oct. 1—Minnesota Section, at Hotel Nicollet, Minneapolis, Minn. Secretary, R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

October 6–7—Four States Section, at Washington, D. C. Secretary, Carl A. Hechmer, Washington Suburban Sanitary District, Hyattsville, Md.

October 10–12—Wisconsin Section, at Milwaukee, Wis. Secretary, L. A. Smith, City Hall, Madison, Wis.

October 13–15—Missouri Valley Section, at Hotel Fort Des Moines, Des Moines, Iowa. Secretary E. L. Waterman, University of Iowa, Iowa City, Iowa.

October 17–20—Southwest Section, at Hotel Biltmore, Oklahoma City, Okla. Secretary, L. A. Quigley, Supt., City Water Works, Fort Worth, Texas.

October 21–22—New Jersey Section, at Berkeley-Carteret Hotel, Asbury Park, N. J. Secretary, H. N. Lendall, Rutgers University, New Brunswick, N. J.

October 26–29—California Section, at Mission Inn, Riverside, Calif. Secretary, Carl M. Hoskinson, Div. of Water, Sacramento, Calif.

October 31–Nov. 2 (*Tentative date*)—North Carolina Section, at King Cotton Hotel, Greensboro, N. C. Secretary, A. R. Hollett, Box 281, Chapel Hill, N. C.

CHANGES IN MEMBERSHIP

New Members, Applications Received April 1 to 30, 1938

ALLEN, LLOYD, JR. Surveyor & Draftsman, 625 So. Berendo St., Los Angeles, Calif.

AMERICAN COLLOID CO. 363 W. Superior St., Chicago, Ill. (Asso. M.)

ANDERSON, FRANK D. Gen'l Meter Foreman, 3148 So. Sacramento St., Chicago, Ill.

ANHEUSER-BUSCH, INC. Mr. G. W. Frieberg, Chief Bacteriologist, 721 Pestalozzi St., St. Louis, Mo. (Corp. M.)

BECK, A. N. Asst. San. Engr., Bureau of Sanitation, State Dept. of Public Health, Montgomery, Ala.

BERGMAN, LEONARD A. Director of Water, City Hall, Buffalo, N. Y.

BORNEMANN, GEORGE F. Supt., Massapequa Water District, Central Ave., Massapequa, N. Y.

BUNDY, DAN. E. Topographical Draftsman, Dept. of Water & Power, 207 So. Broadway, Los Angeles, Calif.

CAMPBELL, GLEN W. Chemist, Water Dept., Bellingham, Wash.

CENTRAL EQUIPMENT SALES CORP. 60 East 42nd St., New York, N. Y. (Asso. M.)

CLIFFS DOW CHEMICAL CO. Marquette, Mich. (Asso. M.)

CLOT, HENRY. Topo. Draftsman, Bureau of Water Works & Supply, 2630 Maceo St., Los Angeles, Calif.

DAGLEY, JACK. Sales Director, Burgess Zeolite Co. Ltd., 72 Horseferry Road, London, S. W. 1, England.

DAY, ISAAC L. Commr. of Public Works, 4 Wheeler Ave., Pleasantville, N. Y.

DIXON, R. M. Sanitary Engr., P. O. Box 2701, Dallas, Texas.

DUNSTAN, JAMES. City Engr., City Engineer's Office, City Hall, Wenatchee, Wash.

FIETEL, ED. E. Pres. & Gen'l Mgr., Water Works, Harvey, La.

FRANCIS, GEORGE WALDEN. Cons. Engr. & Mgr. of Francis Engineering Co., 303 Eddy Bldg., Saginaw, Mich.

GOETZ, JOHN A. Supt. Water Dept., Mattoon, Ill.

GRAHAM, D. W. Chief Chemist & Bact., Dept. of Water & Power, 207 So. Broadway, Los Angeles, Calif.

HARVEY, L. R. Salesman, Johns-Manville Corp., 448 West 24th Ave., Spokane, Wash.

HICKCOX, R. M. Water Supt., Water Shop, Wenatchee, Wash.

HUGHES, GRESHAM. Mgr. & Secy., Mildura Urban Water Trust, Box 111, Mildura, Victoria, Australia.

HUNTINGTON WATER WORKS. Mr. S. P. Hull, Supt., Huntington, Ind. (Corp. M.)

HURD, EDWIN C. Cons. Engr., 1039 Architects & Bldrs. Bldg., Indianapolis, Ind.

KENNY, NORBERT J. Pres. National Meter Co., 4207–1st Ave., Brooklyn, N. Y.

LAKEWOOD WATER CO. Mr. Newman Cheek, Pres., Madison, Tenn. (Corp. M.)

LYBROOK, W. M. Supt. Water & Sewer Depts., P. O. Box 2037, Greensboro, N. C.

MALONE, M. CARROLL. Civil Engr., Bureau of Water Works & Supply, Box 240 Arcade Annex, Los Angeles, Calif.

McKAGUE, JOHN J. Repr., National Meter Co., 4207—1st Ave., Brooklyn, N. Y.

MERRICK, MARLOWE M. Engr. Juntas Mejoras, 16 de Septiembre 58, Mexico, D. F., Mexico.

MILFORD, T. H. Asst. San. Engr., State Dept. of Public Health, Montgomery, Ala.

MURPHY, JAMES P. Filter Plant Supt., 119 Reformatory Ave., Pontiac, Ill.

NOGUERA, GOSTAVO. Apartado 1509, Bogota, Colombia, S. A.

POHL, JOHN A. Engineering Draftsman, Bureau of Water Works & Supply, 3817 Sheffield Ave., Los Angeles, Calif.

PRITCHETT, DAVID H. Supt., Mun. Light & Water Plant, Madisonville, Ky.

RIDENOUR, RALPH O. Jr. Civil Engr., 1039 Redondo Blvd., Los Angeles, Calif.

RIGGS, ROBERT L. City Engr., Box 5294, Daytona Beach, Fla.

(*Continued on page 32*)

NEWS OF THE FIELD

Paul W. Frisk, manager of the chemical laboratory of the American Enka Corporation of Enka, N. C., and director representing the North Carolina Section on the A.W.W.A. board, was elected president of the Engineers Club of Western North Carolina at an organization meeting in Asheville on May 17th.

The club was organized to raise the standards of ethics of the engineering profession, to promote friendship and cooperation among various engineering groups and to assist the young engineer who has just graduated from college and who is attempting to find his place in the engineering field.

Edward S. Hopkins, principal sanitary chemist of the Bureau of Water Supply, Baltimore, Maryland, since 1926, has been appointed filtration engineer of the bureau and assumed his new position on May 15, 1938. He succeeded Mr. James W. Armstrong (who retired on December 1, 1937), and will direct the operations of Baltimore's water purification system.

"Sanitary Engineering as a Career" is the subject of a well-edited brochure prepared by The Institute for Research, of Chicago. So much of inspiration to members of this Association is contained in it that excerpts are given herewith:

"Sanitary engineering has to do, among many other things, with applying the forces of nature in designing and building structures that will promote clean and healthful environment generally. One of its several functions is to control environment so as to prevent the cause of disease, to increase the length of life, and to make for happier and more pleasant living conditions. In times of a typhoid fever epidemic, the physician's job is to cure those who are sick; the sanitary engineer's job is to control the environment so as to prevent the recurrence of the disease. Hygiene has the purpose of preserving the health of the individual under the advice and care of the physician. Sanitary science devotes itself to protecting and preserving the health of the whole community through the mutual action of the physicians, civil authorities, and engineers. The sanitary engineer works in close coöperation with the government, the bacteriologist, the physician, the agriculturalist, and the industrialist.

"Sanitary Engineers are employed by: 1. Governmental agencies, including those of city, county, county district, state and federal. 2. Manufacturers or contractors engaged in the building of water and sewage plants or equipment therefor. 3. Private firms of consulting engineers.

(Continued on page 2)

(*Continued from page 1*)

4. Industries that have special problems of sanitation, particularly in waste disposal and water supply. Also the same industries—or others—that are concerned with the health conditions of their employees with especial reference to working conditions.

"While the Census Bureau of the United States does not have a separate classification for sanitary engineers, it is still possible to estimate the number engaged in the profession. The combined membership of the American Water Works Association, the Sewage Works Association, and the New England Water Works Association, allowing for duplication of membership, in round numbers is 4,700. To this number may be added another thousand representing young engineers who have not yet become members of these associations, bringing the estimated total of practicing engineers in the profession up to between 5,700 and 6,000."

"Present-day problems that come within the scope of modern sanitary engineering have been well enumerated by the Bureau of Sanitary Engineering of the Department of Health of Chicago, as follows:

" 'It was not so many years ago when people generally thought of the field of sanitary engineering as one limited to questions of water supplies, stream pollution, trade wastes, and the collection and disposal of garbage and sewage. Engineering methods have proved so successful that now they are being applied in many other lines of sanitation, and at present the sanitary engineer is called upon to deal also with pasteurization of milk; protection of oyster-growing areas; problems of housing, such as overcrowding, light, heat and ventilation; malaria control, plague eradication; destruction of vermin; industrial sanitation; smoke abatement; noise reduction; protection of swimming pools and bathing beaches; special hazards of comparatively recent importance, such as poisonings by refrigerants, chemicals used in fumigation, and by hair dyes, shoe dyes, moth-proofing compounds, and like products; and the abatement of nuisances of many kinds.'

"The conception of public health, therefore, has grown enormously beyond the traditional bounds of sanitary engineering. Yet every new activity listed above is included in sanitary engineering. After all, there is no fundamental difference between providing a city with a pure water supply and in seeing that its people get to breathe pure air in theaters and other places of public assembly.

"The growth of the public health movement in enlarging the field of sanitary engineering has resulted in considerable part from the activities of the public health worker, who, in many cases has little knowledge of engineering practices—especially with reference to the details of design

(*Continued on page 4*)

Nothing takes the place of the

LEVER

Nothing takes the place of

CAST IRON PIPE

THE LEVER and fulcrum as an engineering principle—cast iron pipe as a long-lived material for underground mains—nothing has taken their place for centuries. Yet both have been highly developed in design and efficiency.

If you demand *proved* long life and low maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—and permanently tight joints —then you will agree that *nothing takes the place of cast iron pipe.* Some materials meet some of these requirements but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE

The Standard Material Q *for Underground Mains*

(*Continued from page 2*)

and plant construction. Since government has entered largely into the regulation and control of health matters, it has, through its public health workers, added to its health activities the specialties that have been listed. Although most sanitary engineers still continue to identify themselves with water and sewage treatment, more and more of them have been drawn into the engineering aspects of public health work. For example, the public health worker endeavors to have provision made for the pasteurization of milk in all dairies supplying the city, but in so doing he is forced to call upon an engineer to perfect the equipment."

"Charles Gilman Hyde, Professor of Sanitary Engineering of the University of California, has divided the sanitary engineer's work of environmental control, or sanitation, into ten groups of activities.

" '1. The quantitative and qualitative control of the air supply.

" '2. The quantitative, sanitary, and esthetic control of the water supply.

" '3. The control of the milk supply; production, transportation, pasteurization, sale, and handling.

(*Continued on page 6*)

WANTED

Sales Representatives

. . . **men who know their way around,** who know what's going on in their territory, preferable with wide acquaintance among municipal, state, federal and health department officials.

Swimming Pool and Sewerage jobs are popping up everywhere. What we want is a few live wires who can hold on and close sales. For such wide awake representatives we have an attractive proposition—a line that more than meets all competition—that includes low priced chlorine sterilizing apparatus (9 types), for water works, sewage plants, swimming pools, dairies, etc., and a large variety of equipment for water treating and water sterilizing, that only need personal contact to close orders running from a few hundred to many thousands of dollars and full factory technical co-operation. If you're the man we want, you'll know the volume of work of this type contemplated in your territory.

Write me personally for proposition stating territory you can cover and qualifications.

R. B. EVERSON, *Pre.*

EVERSON MANUFACTURING CO.

"The Swimming Pool People"

221 W. Huron St., Chicago, U. S. A.

Let it RAIN—Let it POUR

Tropical downpours—even floods—don't impair stocks of Tegul-MINERALEAD waiting to go to work • This ingot form doesn't mind water a bit. Rain or shine, it's ready whenever *you* are. • Another big advantage: the ingot cannot change in composition en route. You don't *hope* it will work—you KNOW it will! • Still *another:* Tegul-MINERALEAD'S quick sealing permits joints to meet at once any reasonable specification as to initial leakage. No delays, Backfilling can be started at once. Tegul-MINERALEAD will serve you *better* because of these exclusive advantages. Write for further information.

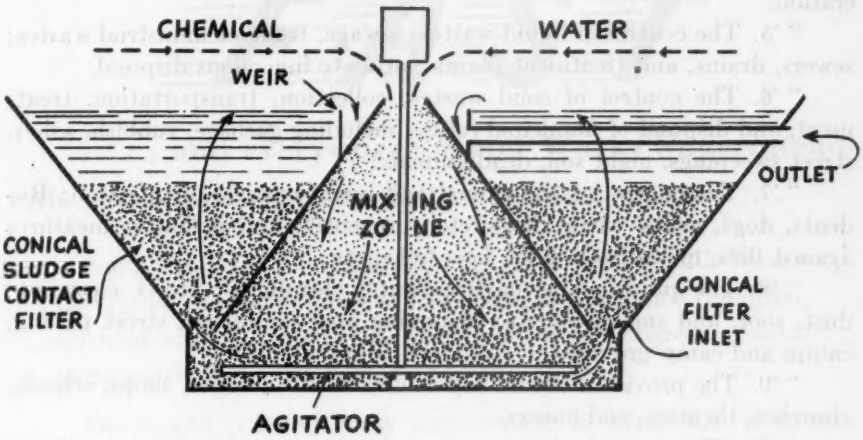
A Tegul PRODUCT

Tegul

MINERALEAD

The ATLAS MINERAL Products Company
of Pennsylvania
Mertztown . . . . Pennsylvania

Cold Lime Treatment Revolutionized by PERMUTIT'S SPAULDING PRECIPITATOR



Typical arrangement of Spaulding Precipitator

Gives Clearer Water! Lower Carbonate Hardness in Much Shorter Time with Less Chemicals

ADVANTAGES: The Spaulding Precipitator consists of two compartments—(a) Mixing Zone, and (b) Conical Upflow Sludge Contact Filter. Chemicals and raw water enter the mixing zone. Here agitators mix the newly forming precipitates with retained older sludge of controlled density—for 30 or 40 minutes. No settling takes place! This feature is *exclusive* with the Spaulding Precipitator.

In ordinary settling basins, sludge settles from water before full reaction occurs. To overcome this, practice has been to return deposited sludge. But this may give the treated water bad taste and odor. In the Spaulding Precipitator, however, *the sludge is kept suspended.* This speeds up precipitation, keeps sludge fresh, cuts down the amount of chemicals needed. Softening is thus completed without putrefaction. Often the treated water is so well stabilized that recarbonation is unnecessary.

OPERATION: After passing through the Mixing Zone, the water is introduced to the Conical Filter uniformly along the periphery of the narrow opening at the bottom. Sludge density is the same in both mixing and filter zones. The agitator's upward thrust, plus the upflowing water's rate of flow keeps a contact filter of conditioned sludge particles suspended in the conical compartment. The conical shape of this compartment also makes the sludge-filter uniformly dense throughout. The top level of this sludge-filter is determined by the rising water's rate of flow.

The mixed water, rising upward, passes through the contact sludge filter. This scrubs or filters out the finer precipitates in the rising water, and leaves the effluent remarkably clear.

As sludge concentrates, it is blown off at a rate set to maintain the correct density of retained sludge.

THESE RESULTS are obtained every day—in practical operation, in both large and small plants. It may also be used for coagulation of turbid or colored waters where lime softening is not required. Would you like more information about this interesting development? Write for free, authoritative booklet on the Spaulding Precipitator to: The Permutit Company, Dept. G2, 330 West 42nd Street, New York, N. Y.

PERMUTIT *The Water Conditioning Headquarters* **OVER 25 YEARS**

(*Continued from page 4*)

" '4. The control of other food supplies; production, transportation, preservation, sale and handling of raw food products; canning; refrigeration.

" '5. The control of liquid wastes; sewage, trade or industrial wastes; sewers, drains, and treatment plants, ultimate innocuous disposal.

" '6. The control of solid wastes; collection, transportation, treatment, and disposal of municipal refuse, including garbage, rubbish, ashes, street sweepings, night soil, dead animals.

" '7. The control of the animal and insect carriers of infection: Rodents, dogs, goats, cattle, hogs, etc.; preventive and palliative measures against flies, mosquitoes, fleas, lice, ticks, etc.

" '8. The provision of environmental cleanliness: Street cleansing; dust, soot, and smoke control; swimming pool sanitation; street paving; camps and camp grounds.

" '9. The provision of sanitary conditions in factories, shops, schools, churches, theatres, and houses.

" '10. The control of nuisances and other unsatisfactory conditions including odors, obnoxious gases, excessive noise, and the like.'

(*Continued on page 8*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2" to 84"

Flanged Pipe ***Flexible Joint Pipe***

Bell and Spigot Pipe

Special Castings ***Short Body B. & S. Specials***

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

GOOD NEWS *TRAVELS*

FAST

. . . . and everywhere Water Works Superintendents are adopting these Better Alums!

Sunny resorts of Florida • industrial cities of the Middle West • Cleveland, Ohio's great metropolis of almost a million • Hamilton, splendid city of Ontario—in these and other progressive communities the news has been heard—and *heeded.*

Towns and cities of every size—centers of every line of endeavor—are enjoying better-tasting water because of Activated Alum and Black Alum—those *more capable coagulants.*

No less than 125 communities have switched to Activated Alum and Black Alum within one year . . . among them:

Batavia, N. Y.	Hopkinsville, Ky.	Southern Pines, N. C.
Cambridge, O.	Laurel, Md.	Trenton, N. J.
Cleveland, O.	Morrisville, Pa.	Villa Grove, Ill.
East Liverpool, O	Newburg, N. Y.	Weldon, N. C.
Fort Myers, Fla.	Newport News, Va.	Wellsville, N. Y.
Fredericksburg, Va.	Petersburg, Va.	Wilkinsburg, Pa.
Hagerstown, Md.	St. Augustine, Fla.	Wilmington, N. C.
Hamilton, Ont.	Sarasota, Fla.	Youngstown, O.

Samples and quotations? Certainly! Write for them today.

In case the good news hasn't reached *you:*

ACTIVATED ALUM is a new type alum—9 molecules of water, instead of 18—and 7 to 9% of colloidal siliceous material, to speed up floc formation.

BLACK ALUM is made with Standard Activated Alum and it costs no more than regular alum.

ACTIVATED ALUM CORP.

AN INDEPENDENT ALUM COMPANY

OFFICE
80 Broad Street
New York City, N. Y.

•

WORKS
Curtis Bay
Baltimore, Maryland

"When you Think of ALUM--*Think of* ACTIVATED"

(*Continued from page 6*)

"Traditionally the field of sanitary engineering has dealt with items 2, 5, in part with 6. But due to the pressure of governmental public health work, opportunities in the other classes of activities have developed. These occur largely in work carried on by the government, whether city, county, state, or federal, of an advisory, supervisory, regulatory, or administrative nature. "A new term has been applied to sanitary engineers in this kind of government service; they are being called **Public Health Engineers.** Their work involves not only the fundamental principles of design, construction, and operation of plants and works, but also, and perhaps more particularly, the control of sanitation, making sanitary surveys, and establishing standards of quality in sanitation which sanitary works should attain and maintain. In fact, most public health engineers, as a matter of practicing policy, review and approve designs for sanitary engineering works and, as a practical proposition, in a great many instances give general guidance in the determining of projects. They also give general advice in the operation of sanitary engineering works. They are charged not only with the detailed problems of performance, which is a highly specialized field, but also with establishing and regulating sanitary

(*Continued on page 10*)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

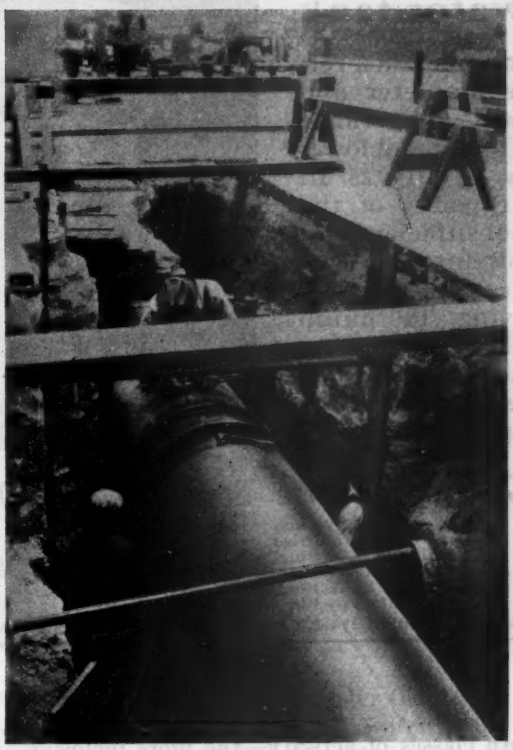
Hand Operated—size 2", 2½", 3", 4"
Power Operated—size 3" and 4"
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

THE ANSWER TO A PROBLEM

ALCO PIPE FOR CHICAGO



Cities using ALCO STEEL PIPE include the following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W Va
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y
New Brunswick, N.J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

The Water Department of Chicago and the Chicago Union Station were jointly and seriously concerned about the material to use in the 36" line to replace pipe running under the tracks of the station. The answer, illustrated above, is Alco Electric Welded Steel Pipe. No further need to worry about disastrous breaks.

ALCO FEATURES

Greater Strength
Longer Life
Smoother Waterway
Longer Lengths
Fewer Field Joints
Low Initial Cost
Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS DIVISION

30 Church Street New York, N. Y.

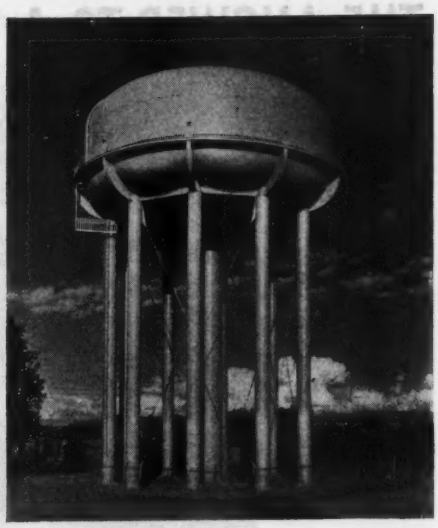
CHICAGO WASHINGTON PITTSBURGH HOUSTON TULSA

Plants at Dunkirk, N. Y., and Montreal, Canada Cable Address: Alproducts

AMERICAN LOCOMOTIVE COMPANY

The COLONIAL design water tank

This design tank has a relatively large diameter and shallow depth. The range between the upper and lower water levels is only 25 ft. The entire capacity of the tank can be of sufficient elevation to flow into the system at effective pressure without having to pump against an excessive head in filling the tank. Write our nearest office for information or estimating figures.



CHICAGO BRIDGE & IRON COMPANY

Chicago	Old Colony Bldg.	Houston	2919 Main Street
Birmingham	1500 N. 50th Street	Los Angeles	Wm. Fox Bldg.
Boston	Consolidated Gas Bldg.	New York	165 Broadway Bldg.
Cleveland	Rockefeller Bldg.	Philadelphia	1700 Walnut Street Bldg.
Dallas	Liberty Bank Bldg.	San Francisco	Rialto Bldg.
Detroit	Lafayette Bldg.	Tulsa	Hunt Bldg.

Plants at BIRMINGHAM, CHICAGO and GREENVILLE, PA.

(*Continued from page 8*)

measures. Both classes of activity—the more inclusive and comprehensive work of the public health engineer and the more restricted work of the sanitary engineer as that work has commonly been practiced in the past—are within the field of sanitary engineering. If any distinction needs to be made, it is that public health engineering represents the broadest possible conception of the older and original term of sanitary engineering.

"Activities to improve the water supply and methods of disposal of sewage and garbage continue to increase and new problems constantly develop. There has been increasing competition among growing cities for an adequate water supply of satisfactory quality. Parallel to that are the often ineffective attempts to avoid overwhelming sewage pollution of our major streams. In 1930, the sewage of over 70 per cent of the urban population went untreated, but between 1930 and 1937 more plants were built for sewage treatment than in the previous 25 years. Most of the sewage treatment plants constructed in the United States during this period were completed largely as a result of financial assistance from the federal government. However, comparable progress was not made in the treatment of industrial wastes.

(*Continued on page 12*)

JUST as these fishermen are going over their nets and floats for greater efficiency and catch, water plant operators should adjust their treatment to compensate for Summer changes in their water supply.

Warm weather invariably promotes excessive algae and other organic growths in raw water supplies, resulting in increased tastes and odors, with its attendant difficulties in controlling. At this Season there is also the increased need of water for drinking and other purposes.

MAKE YOUR WATER SUPPLY INVITING TO DRINK . . . MAKE IT SPARKLING . . . . MAKE IT PALATABLE . . . . *IT'S EASY TO DO WITH AQUA NUCHAR.*

INDUSTRIAL CHEMICAL SALES

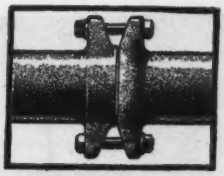
DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

230 Park Avenue, New York, N. Y. | 205 W. Wacker Drive, Chicago, Ill. | 417 Schofield Bldg., Cleveland, Ohio

Manufacturers of POWDERED ACTIVATED AQUA NUCHAR CARBON **Activated Carbon**

UNIVERSAL CAST IRON PIPE

LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

THE CENTRAL FOUNDRY COMPANY

General Offices: 386 FOURTH AVENUE, NEW YORK

CHICAGO, ILL., 1105 W. 36th St. - OAKLAND, CALIF., 278 Fourth St.

OFFICES IN PRINCIPAL CITIES COAST TO COAST

(*Continued from page 10*)

"Notwithstanding all that has been done, the problem of sewage and industrial waste treatment remains one of the most important problems confronting the people of the nation. It cannot be solved until the public is aware of the acute health and conservation hazards involved. The future offers many problems in that field for the sanitary engineer to solve. After the streams have been protected from the dumping of raw sewage and trade wastes, the next most important problem is the extraction of by-products from these wastes. In trade wastes, especially, the nitrogenous materials of the organic chemical industries may supply compounds of considerable value.

"The water supply problem is not as simple as it once was. The public no longer merely demands an adequate supply of water of sufficient hygienic purity. It demands a quality of water that not only has safety, but also is cool and sparkling, with an absence of taste, odor, color, a freedom from corrosiveness, and a softness for both home and industrial use. Supplying a community with water of this type, includes sanitation of the whole watershed involved. This may mean securing control, as far as sanitation is concerned, of territory a hundred or more miles away,

(*Continued on page 14*)

FIRST QUALITY METERS EXCLUSIVELY

SPECIFY *American* (BRONZE CASE) or *Niagara* (IRON CASE)

Water Meters

WRITE FOR CATALOG

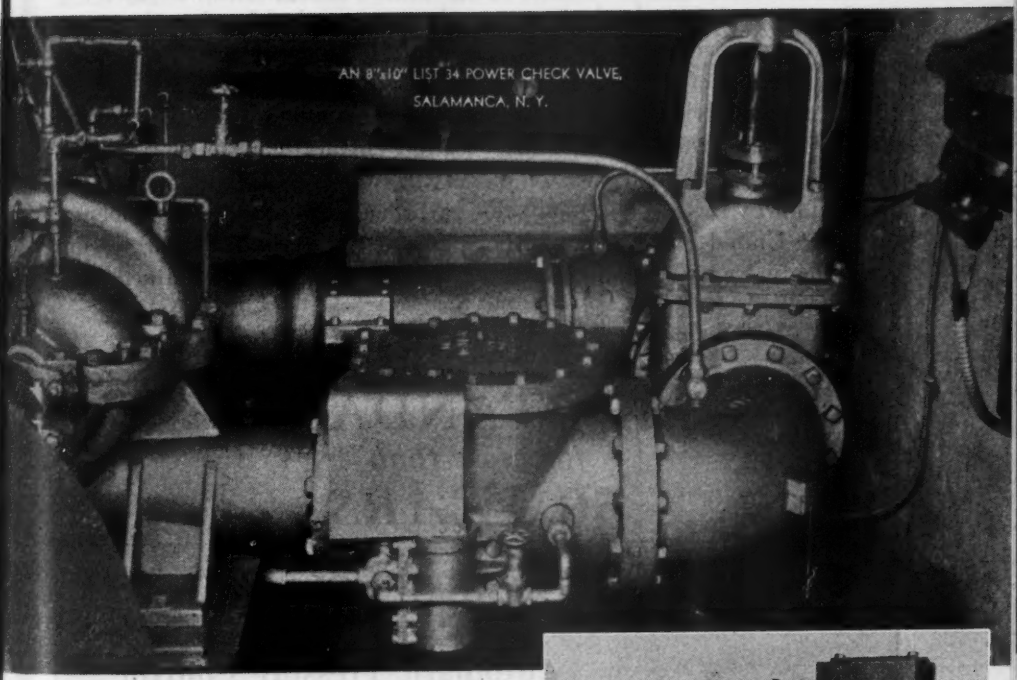
BUFFALO METER COMPANY

Established 1892 — 2914 Main St., Buffalo, N. Y.

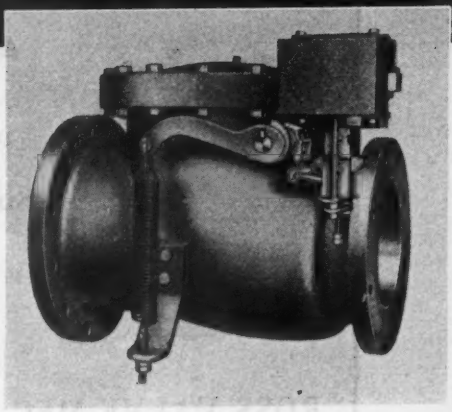
FOR QUIET CLOSURE & MAXIMUM EFFICIENCY—INSTALL

RENSSELAER

LIST 34 POWER CHECK VALVES



AN 8"x10" LIST 34 POWER CHECK VALVE,
SALAMANCA, N. Y.



Positively eliminates slam on pump shut-down.

Full clearway opening reduces head loss and cuts power costs.

Simplicity of design and rugged construction results in trouble-free operation over a period of years.

Bulletin "V" mailed on request

RENSSELAER VALVE COMPANY, TROY, N. Y.

(*Continued from page 12*)

as well as all intervening territory along the line of water supply that might in any way affect that supply.

"Looking ahead we can see what future developments may take place. Since we know what pure water is and how to get it, then better methods, better control, and more economical procedure will be developed. It is likely that improved sterilizing methods may be discovered. The sanitary engineer is continually experimenting to solve these problems.

"There are a multitude of problems in sanitary engineering that call to a person for solution. These range from the hydraulic design of a sewer to research in endemic diseases and the removal of fluorine, the cause for the occurrence of mottled enamel in teeth of young people living in certain sections of the United States.

"Another advantage is that the profession is not overcrowded, nor is it likely to be, in the opinion of many leading engineers, in the years immediately ahead. A great deal of pioneering spirit exists and can be accounted for by the fact that new sanitary projects are always being opened up in the United States and in other parts of the world. The profession is offering more and more opportunity for men who are well trained.

(*Continued on page 16*)

THE STANDARD
for more than
50 YEARS

WATER WORKS SPECIALTIES

•

Automatic Pressure Control Valves

Pressure Reducing-Altitude

Surge-Relief and Combination Valves

Portable Fire Hydrants

Hydraulic Booster Pumps

ROSS VALVE MFG. CO., INC. TROY, N. Y.

avoid COSTLY PIPE LINE BREAKS

• Bid goodbye to sudden ruptures and costly leakage by specifying Armco Spiral Welded Pipe for that new water supply line. This way you can be sure of a strong, bottle-tight line that will serve your needs *continuously* without expensive maintenance. • You'll also gain these other dollar saving advantages of Armco "Spiral Welded": its wide range in diameters and wall thicknesses; its adaptability to various joints, coatings and fittings; its unequaled smoothness of interior; and its long lengths that save up to 308 joints per mile! • Dozens of cities already have reduced their water transportation costs with Armco Spiral Welded Pipe. Let us help you achieve the same results. The American Rolling Mill Company, Pipe Sales Division, 141 Curtis Street, Middletown, Ohio.

Immunity to sudden rupture was one reason why Armco Spiral Welded Pipe was specified for this penstock in Colorado.

ARMCO SPIRAL WELDED PIPE

(*Continued from page 14*)

"The greatest source of satisfaction is in the realization that significant achievements have been made in benefiting human life. The advantage of which a sanitary engineer speaks most often is that he is identifying himself with the performance of decidedly worth while things. Not only are they worth while, but they are extremely fascinating to men with inquiring minds.

"The profession has its unpleasant aspects, and they must be recognized. A sanitary engineer in the employ of a public health agency is a public servant. His work and responsibility are not with individuals, such as is the work of a lawyer or a doctor, whose standing and fee charges are determined by his own reputation and the wealth of his clients. The engineer's performance in safeguarding the public health is accepted with no special gratitude. In time of flood or typhoid epidemic, or when the water has a bad taste or odor, the public heaps upon the engineer many unwelcome attentions."

"The sanitary engineer today needs to have a thorough knowledge of the nature of the political and economic activities of his community

(*Continued on page 18*)

CLEAN YOUR WATER MAINS

One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

50 Church St., New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.

LOW TOTAL COST

of operation has been the objective in developing

DE LAVAL *Centrifugal* PUMPS

● De Laval 12 in. pumps to handle 2080 g. p. m. each of sludge containing one per cent of solids.

THE INITIAL EFFICIENCY IS HIGH and long sustained, primarily due to the De Laval Labyrinth Wearing Rings, which are used in all cases. As compared with older pumps, the higher efficiencies now obtained will repay the cost of De Laval Pumps in a short time. Renewable wearing parts are used at all points subject to wear. As the pumps are built to limit gages, these parts are interchangeable and renewals ordered by number can be installed at minimum expense and without delay.

Each pump is guaranteed as to characteristics and operation and is tested at our Works.

3201

DE LAVAL STEAM TURBINE COMPANY, TRENTON, N. J.

(*Continued from page 16*)

and country, since much of his work will be done among government officials and through government procedures and routine. Further, his responsibility as a good citizen is sharply focused because of the highly social nature of his profession. His education and line of experience, therefore, should be finely balanced, so that he can meet people of all social levels on their own ground. The proportion should be well adjusted between pure science on the one hand and practical and commercial judgment on the other.

"It is becoming more and more necessary for the sanitary engineer to have good business capacity. He must possess sound judgment and the ability to be a good administrative head in helping to set up policies and in bringing them to fulfillment. In the business of operating various plants, he is expected to show the maximum efficiency at the greatest economy. As a leader he must be able to manage men and to have them like and respect him. His work brings him in contact with the farmer and the manual laborer. There should be, as well, mutual respect between him and his brother engineers. He must also have the moral stamina to be able to direct his activities in his particular position of building and

(*Continued on page 20*)

Veteran Craftsman*

*Frank Droesch. Veteran Craftsman who has built thousands of large-size Empire Meters

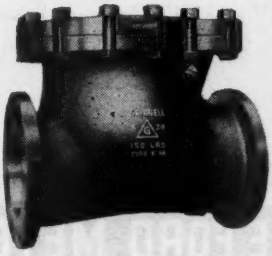
Although every type of National Meter has outstanding features of design, it is the experience, the training, the skill of the men who make them . . . not merely the modern equipment employed . . . that insures the translation of these features into dependable water meters . . . meters that will measure flows both large and small with lasting accuracy and at the lowest cost for maintenance through years of service.

NATIONAL METER COMPANY, 4203 First Avenue, Brooklyn, N. Y.

NATIONAL Meters

Boston • Chicago • Dallas • Los Angeles • San Francisco

CHECK VALVES for Complete Control



Uniflow Check Valves*

Detector Check With Meter In By-Pass*

*Grinnell Check Valves are all bronze, with bronze clappers and molded rubber facings. They are made to specifications of, and approved by, Factory Mutual Laboratories.

Used in pairs, these check valves stop water from secondary source backing up in public mains, thus preventing contamination.

• • • •

*Leakage or possible misuse of water in fire protection equipment is eliminated with this Grinnell Check Valve. By-pass and meter accurately measures flows to slightly over 25 gallons per minute, fully sufficient to indicate any flow except for fire extinguishment. Grinnell Company, Inc., Executive Offices, Providence, R. I., Branch offices in principal cities.

GRINNELL

...WHENEVER PIPING IS INVOLVED...

(*Continued from page 18*)

maintaining adequate sanitary facilities in the face of public indifference—a public preferring economy to adequate protection in health matters.

"Of outstanding importance to the sanitary engineer is the ability to speak and write well. Every engineer must be able to write a coherent, accurate report in technical language and to speak in technical terms to other members of his profession, but a sanitary engineer has to do a more difficult thing. Because he has so much contact with the public, and his responsibility is to insure the welfare and health of a large number of people, he must be very skillful in speaking to and being understood by many groups of people. These include financiers and business men who back undertakings, politicians who have great power over the construction and operation of many public enterprises, and the citizens themselves who must be informed and convinced as to the nature of the needs in the many sanitary enterprises. Only too often a finely trained expert is powerless because he is not able to "speak the language" of and convince those who hold the power.

(*Continued on page 22*)

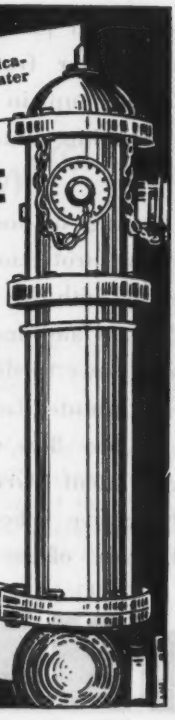
Complying with the Specifications of the American Water Works Ass'n.

KUPFERLE Fire Hydrants

Send for specification sheets of Kupferle Fire Hydrants; types and sizes to meet requirements of all public and private installations. Backed by a half century of proven performance.

JOHN C. KUPFERLE FOUNDRY CO. ST. LOUIS

NO. 100. Tested and Approved by National Board of Fire Underwriters.



THE FORD METER MITTEN

WILL SAVE FROZEN METERS

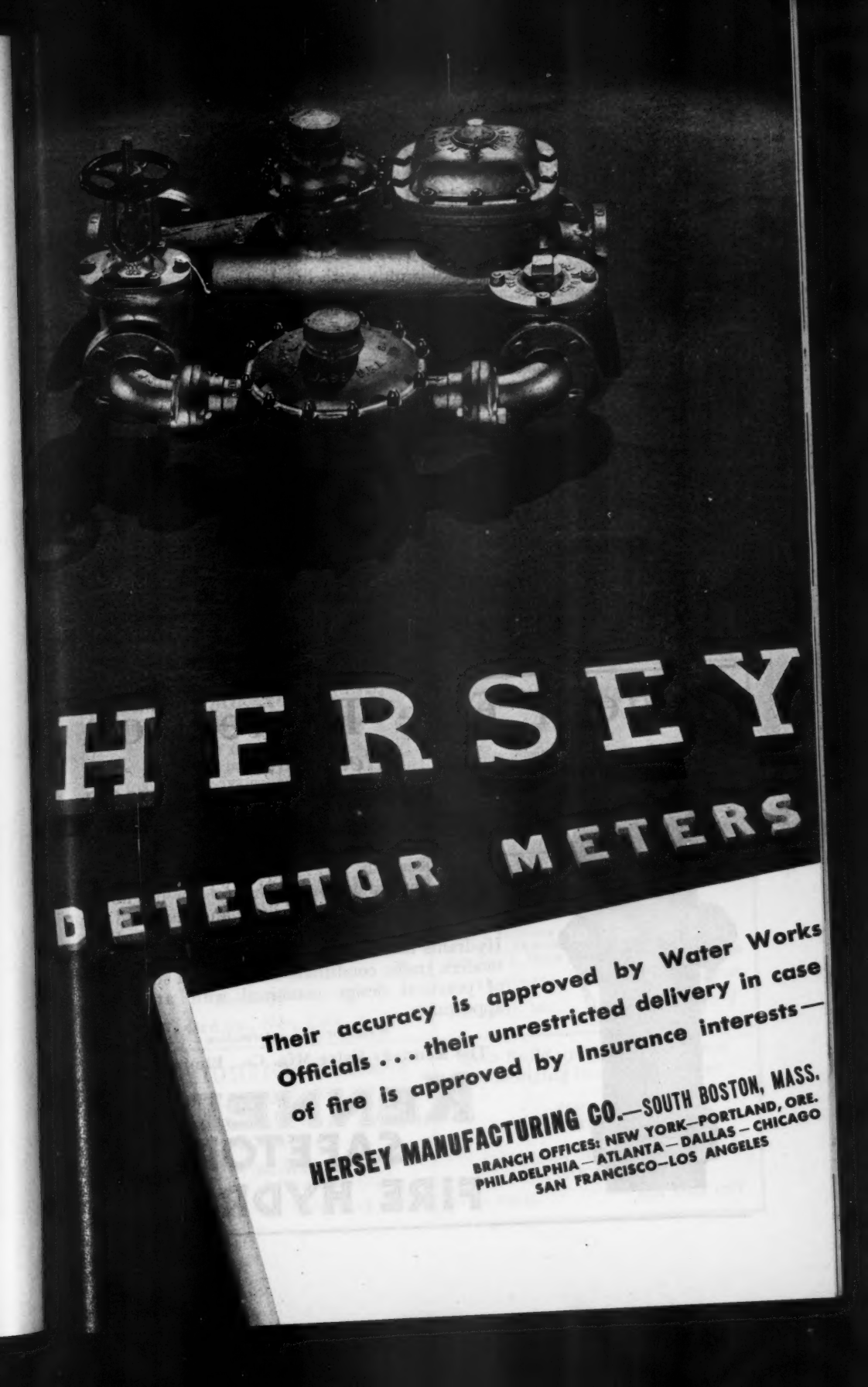
Made for meters up to 1" in size.

Simple and easy to install.

The Meter Mitten is a convenient and effective insulation jacket for basement meters. Conserves warmth in meter and water and prevents many meters from freezing. Costs but a fraction of the expense of a frozen meter. Write for further information.

The Ford Meter Box Co.

WABASH, INDIANA


HERSEY
DETECTOR METERS
Their accuracy is approved by Water Works Officials . . . their unrestricted delivery in case of fire is approved by Insurance interests—
HERSEY MANUFACTURING CO.—SOUTH BOSTON, MASS.
BRANCH OFFICES: NEW YORK—PORTLAND, ORE.
PHILADELPHIA—ATLANTA—DALLAS—CHICAGO
SAN FRANCISCO—LOS ANGELES

(*Continued from page 20*)

"Finally, a good sanitary engineer is conscientious, truthful, trustworthy, discreet and has good control of his temper. He takes an energetic interest in his work and is firmly convinced that whatever he is doing is for the welfare of society. Also, early in his career he realizes that the learning period of an engineer ends only with his death, that what he has learned in college is but a beginning of what he learns through self education, opportunities, and experience throughout the rest of his life."

Industrial and Engineering Chemistry, in the editorial columns of the June issue, carries such a striking and well-informed statement on behalf of American industry that it is quoted here for the benefit of the water works field:

"It has become something of a habit to attack industry. The greater the industry, as measured by money invested and facilities, the louder the attack. But even the smaller groups are not immune at times. If industry needs a witness for its defense, no better one than research can be found.

"Notwithstanding all the efforts at educating the public, there is still

(*Continued on page 26*)

Modern Fire Protection

demands

SAFETOP FIRE HYDRANTS

ARE you planning any water service extensions in your community? If so, be sure to specify Kennedy SAFETOP Fire Hydrants—to provide maximum protection to the neighborhood, with minimum maintenance expense to your department. Kennedy SAFETOP Fire Hydrants meet modern fire service requirements, modern traffic conditions, and modern standards of practical design combined with attractive appearance.

Write for full information

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY SAFETOP FIRE HYDRANT

REG. U.S. PAT. OFF.

MORRIS KNOWLES, INC.

Engineers

Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.

Pittsburgh, Pa.

ALEXANDER POTTER

Consulting Engineer

Specialties: Water Supply and Sewerage

50 Church St. **New York City**

Telephone 5501 Cortlandt

METCALF & EDDY

Engineers

Charles W. Sherman — John P. Wentworth
Almon L. Fales — Harrison P. Eddy, Jr.
Frank A. Marston — Arthur L. Shaw
E. Sherman Chase

Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories — Valuations

Boston, Mass. **Statler Building** — **Harrisburg, Pa.** **Telegraph Building**

CLYDE POTTS

M. Am. Soc. C. E.

Consulting Sanitary Engineer

30 Church Street - - New York

Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

REEVES NEWSOM

Engineer - Consultant

Supply, Purification and Distribution of Water

Operation **Design** **Construction**
Valuation **Rates** **Negotiations**
Investigations **Taxes** **Accounting**

500 Fifth Avenue **New York City**

SCOFIELD ENGINEERING CO.

Consulting Engineers

Water, Gas, Electric Plants and Distribution Systems

Appraisals, Valuations and Reports
Design—Supervision—Operation

Philadelphia, **Penna.**

PEASE LABORATORIES, INC.

39 West 38th Street, New York

Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.

Chemists Field Sanitary Surveys
Bacteriologists **Consultants**

WESTON & SAMPSON

Robert Spurr Weston **G. A. Sampson**

Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.

14 Beacon St. **Boston, Mass.**

MALCOLM PIRNIE

Engineer

Water Supply, Treatment, Sewerage,
Reports, Plans, Estimates,
Supervision and Operation
Valuation and Rates.

25 W. 43rd St., New York, N. Y.

WHITMAN, REQUARDT AND SMITH, *Engineers*

Ezra B. Whitman — Norman D. Kenney
Gustav J. Requardt — Robert T. Regester
Benjamin L. Smith — Theodore W. Hacker

WATER WORKS - SEWERAGE - UTILITIES

Baltimore, Md. — Albany, N. Y.

THE PITOMETER COMPANY

Engineers

Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings

50 Church St. **New York City**

Help Build up Your Association by Bringing in a New Member

SEND FOR APPLICATION BLANK

AMERICAN WATER WORKS ASSOCIATION

22 East 40th St. **NEW YORK CITY**

(*Continued from page 20*)

"Finally, a good sanitary engineer is conscientious, truthful, trustworthy, discreet and has good control of his temper. He takes an energetic interest in his work and is firmly convinced that whatever he is doing is for the welfare of society. Also, early in his career he realizes that the learning period of an engineer ends only with his death, that what he has learned in college is but a beginning of what he learns through self education, opportunities, and experience throughout the rest of his life."

Industrial and Engineering Chemistry, in the editorial columns of the June issue, carries such a striking and well-informed statement on behalf of American industry that it is quoted here for the benefit of the water works field:

"It has become something of a habit to attack industry. The greater the industry, as measured by money invested and facilities, the louder the attack. But even the smaller groups are not immune at times. If industry needs a witness for its defense, no better one than research can be found.

"Notwithstanding all the efforts at educating the public, there is still

(*Continued on page 26*)

Modern Fire Protection

demands

SAFETOP FIRE HYDRANTS

ARE you planning any water service extensions in your community? If so, be sure to specify Kennedy SAFETOP Fire Hydrants—to provide maximum protection to the neighborhood, with minimum maintenance expense to your department. Kennedy SAFETOP Fire Hydrants meet modern fire service requirements, modern traffic conditions, and modern standards of practical design combined with attractive appearance.

Write for full information

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY SAFETOP FIRE HYDRANT

REG. U.S. PAT. OFF.

MORRIS KNOWLES, INC.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.
Pittsburgh, Pa.

ALEXANDER POTTER
Consulting Engineer
Specialties: Water Supply and Sewerage
50 Church St. New York City
Telephone 5501 Cortlandt

METCALF & EDDY
Engineers
Charles W. Sherman — John P. Wentworth
Almon L. Fales — Harrison P. Eddy, Jr.
Frank A. Marston — Arthur L. Shaw
E. Sherman Chase
Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories — Valuations
Boston, Mass. Statler Building — **Harrisburg, Pa.** Telegraph Building

CLYDE POTTS
M. Am. Soc. C. E.
Consulting Sanitary Engineer
30 Church Street - - New York
Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

REEVES NEWSOM
Engineer - Consultant
Supply, Purification and Distribution of Water
Operation — Design — Construction
Valuation — Rates — Negotiations
Investigations — Taxes — Accounting
500 Fifth Avenue New York City

SCOFIELD ENGINEERING CO.
Consulting Engineers
Water, Gas, Electric Plants and Distribution Systems
Appraisals, Valuations and Reports
Design—Supervision—Operation
Philadelphia, Penna.

PEASE LABORATORIES, INC.
39 West 38th Street, New York
Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.
Chemists Field Sanitary Surveys
Bacteriologists Consultants

WESTON & SAMPSON
Robert Spurr Weston — **G. A. Sampson**
Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.
14 Beacon St. Boston, Mass.

MALCOLM PIRNIE
Engineer
Water Supply, Treatment, Sewerage,
Reports, Plans, Estimates,
Supervision and Operation
Valuation and Rates.
25 W. 43rd St., New York, N. Y.

WHITMAN, REQUARDT AND SMITH, *Engineers*
Ezra B. Whitman — Norman D. Kenney
Gustav J. Requardt — Robert T. Regester
Benjamin L. Smith — Theodore W. Hacker
WATER WORKS - SEWERAGE - UTILITIES
Baltimore, Md. Albany, N. Y.

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings
50 Church St. New York City

Help Build up Your Association by Bringing in a New Member
SEND FOR APPLICATION BLANK
AMERICAN WATER WORKS ASSOCIATION
22 East 40th St. NEW YORK CITY

(*Continued from page 22*)

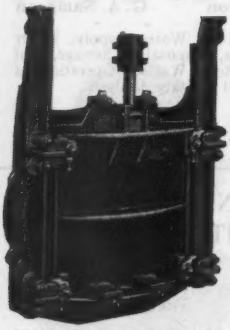
only a small percentage interested in scientific research, except as its application can be measured by the things it helps to provide which enrich life in one way or another. There is ample evidence of just that kind which can be directly attributed to research without going into the controversial question as to whether science destroys or creates the greater number of jobs.

"From several sources have come the figures we are about to quote, bearing upon the tangible results for the consumer, as measured by a decrease in cost and a high increase in efficiency, owing to the investment of industry in the work of the scientist. It will be recognized that nearly all of these changes have come to the public at the hands of big business rather than from the small concerns which, for some unknown reason, seem generally to be regarded as the more wholesome and purer of the two.

"In 1915 the average life of an automobile tire was about 3000 miles, whereas today it is approximately 20,000 miles, while the costs are about 25 per cent of the earlier prices. In 1928, 1475 cubic feet of gas from coal could be purchased for a dollar. In 1938 the figure is 1727 cubic feet. An electric refrigerator which cost $334 ten years ago has its place taken

(*Continued on page 28*)

LUDLOW



Sluice Gates

The new improved Ludlow sluice gate features adjustable wedges at sides, top, and bottom. These gates can be furnished for circular, square, or rectangular openings, in rising and nonrising types and with various types of operating controls.

Write for prices and specifications.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

It makes NO difference to

% PROPORTIONEERS %

WHAT

YOU USE

NUCHAR
Industrial Chemical Sales Co.

DARCO
Darco Company

BLACK ALUM
Activated Alum, Inc.

CLIFFCHAR
The Cliffs Dow Chemical Co.

Can all be fed by %Proportioneers% "Little Red Pumps." We supply the apparatus to measure and pump the carbon suspensoid, the agitator tank to keep it in suspension, and the control to keep the feed constant or vary it with flow. Write for Bulletin "RED".

% PROPORTIONERS, Inc. %
18 Codding St., Providence, R.I.

When father was a boy

Even so short a time ago as our father's generation, there was still much localized resentment against installing "these damnfangled costly water systems". "If our water was good enough for my father to drink . . ." was heard in many a town meeting of that time.

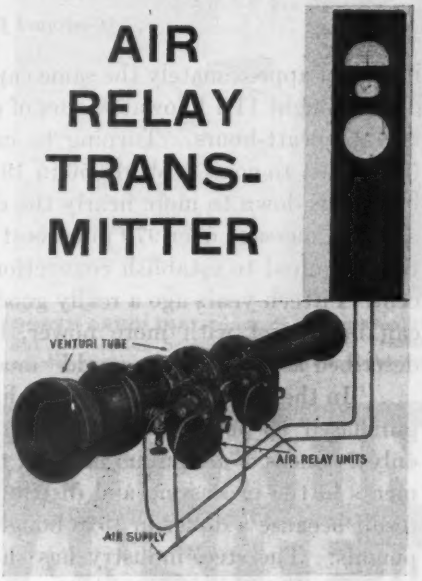
Today, the typhoid rate of North America is the lowest in history . . . adequate confirmation that liquid chlorine is doing its job well.

Solvay's new "Big 3" Liquid Chlorine Service is designed to fulfil the requirements of modern water purification and sanitation systems. This service is not only designed for quick and convenient delivery of Liquid Chlorine. It is a service system upon which State and municipal authorities can depend for adequate supplies in times of emergency . . . upon which they can depend for advice and technical assistance when it is required. Solvay Liquid Chlorine shipments are now routed from Syracuse, New York; Hopewell, Virginia; and Baton Rouge, Louisiana. Your inquiries on Solvay Liquid Chlorine are cordially solicited. Please write to

SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 RECTOR STREET NEW YORK, N. Y.

SOLVAY
LIQUID CHLORINE

AIR RELAY TRANS-MITTER



A marked advance in flow metering

The new Air Relay Transmission System simplifies some difficult installations. Attached to the inlet and the throat of the Venturi Tube, as shown in the illustration, each Air Relay Unit is connected by a small pressure tube to the Registering Instrument. A connection to the regular plant air supply (or to a small garage type compressor unit) completes the installation. Simply turn on the air. The Air Relay Units are entirely self-balancing and there are no valves or other devices to adjust.

In Water Works Service

Through the use of the Air Relay the Register can be located at a distance from the Tube, or can be grouped with other Registers, at a central point. Low head installation can be operated without float pipes, head pipes, or detached wells.

For Sewage and Sludge Measurement

The Air Relay Unit positively prevents the sewage and sludge metered from coming into contact with the instrument and eliminates sediment tanks, detached well units, head pipes, and open float pipes.

The Air Relay Transmission System is equally suitable for your new or existing installations.

BUILDERS IRON FOUNDRY
"Builders of Venturi Since 1891"
9 CODDING ST., PROVIDENCE, R. I.

(*Continued from page 26*)

by one of approximately the same capacity but selling for $169. In 1912 a dollar bought 11.1 kilowatt-hours of electricity; in 1927, 14.7; and in 1937, 22.7 kilowatt-hours. Turning to communications, a telephone message from coast to coast cost $18.50 in 1918; $9.00 in 1928; $6.50 in 1938. To bring this down to more nearly the distance most of us telephone, a long-distance message over 970 miles cost $7.50 in 1926; $2.75 in 1936; and the time required to establish connections has been reduced by about 70 per cent Fifteen years ago a really good radio cost $200. Today for $50 one can buy a set with more power, better reception, and entitled to be described as "around the world" model.

"In the cement industry there has been efficient progress, for 50 cents purchased 99 pounds in 1923 and 127 pounds in 1937. A dollar bought only 2 ounces of aluminum in 1888; today it will buy 5 pounds. Improvements in the processing and distribution of milk products show a similar result because a dollar in 1928 bought 49.5 pounds and today it buys 56.5 pounds. The steel industry has shown an increase in prices of about 8 per cent, but this is for a better steel than was formerly available, and during this improvement the raw material cost has advanced 11 per cent,

(*Continued on page 30*)

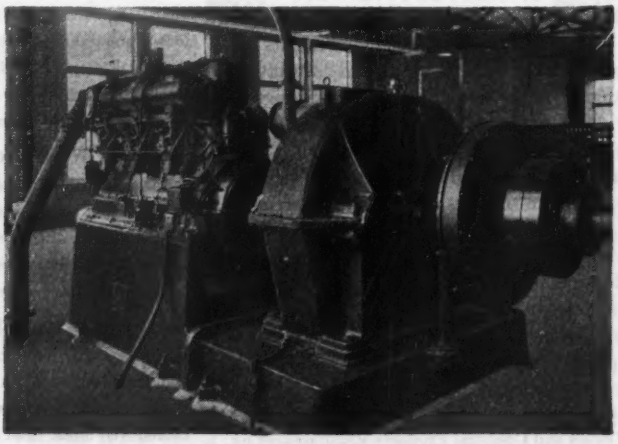
PROGRESS IN METALLURGY

Applied to Sterling Gas and Gasoline Engines Results in Great Savings.

STERLING HIGH DUTY

Sterling

INTERNAL COMBUSTION ENGINES



425 H.P., 1200 R.P.M. Sterling gasoline engine at Glen Alden Coal Company, Askam Shaft, for emergency mine fan drive,—with quick automatic starting.

Increased engine speeds—900 R. P. M. for continuous service—1200 R. P. M. intermittent duty—result in lower first cost, lesser installation costs and minimum carrying charges. Sterling engines can save you thousands of dollars and give you better service.

GAS — GASOLINE — DIESEL — ENGINES

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

STERLING ENGINE COMPANY
Dept. C-3

Branch Office
900 Chrysler Bldg.
New York, N. Y.

PENNSYLVANIA: Long lengths of Transite Pipe are comparatively light, easily transported to the job and rapidly handled by installation crews.

NORTH CAROLINA: Hundreds of municipalities throug out the United States are finding in Transite Pipe t answer to their water-transportation problems.

SAVINGS JUST STARTING ON THESE 3 TRANSITE JOBS

EVERY community that installs J-M Transite Pipe enjoys this 3-way saving in water transportation...

INSTALLATION is economical. The long lengths of Transite Pipe are light, transported to the job at low cost and easily handled by installation crews. Simplex Couplings speed up assembly . . . require no caulking . . . eliminate the need for large bell holes. Trenches can be held to minimum width.

MAINTENANCE is practically zero. Transite Pipe is made of two inherently permanent minerals, asbestos and cement. It has exceptional resistance to the corrosive action of acid soils and ground waters. And because it is non-metallic, it is immune to electrolysis.

PUMPING COSTS are low at the start, because J-M Transite Pipe has an unusually smooth interior surface. And it *stays* smooth. Transite, being non-metallic, *can never tuberculate*. This does away with one of the major causes of increased pumping pressures and reduced carrying capacities.

The more you know about Transite Pipe, the more clearly you will see why it assures efficient, permanently economical water-carrying systems. For the new Transite Pressure Pipe Brochure, write Johns-Manville, 22 East 40th Street, New York City.

NEVADA: Long sweeps can easily be laid with straight lengths of Transite Pipe. Simplex Joints are flexible, yet remain permanently bottle-tight.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville

TRANSITE PRESSURE PIPE

AN ASBESTOS PRODUCT

But Valueless for Water Purification

Although the diamond is carbon in its most valuable form, it is worthless compared to CLIFFCHAR ACTIVATED CARBON for water purification.

Leading municipalities place high value on CLIFFCHAR to remove objectionable taste and odors from water supply.

CLIFFCHAR "R"

Special Grade for Water Purification

Low phenol value, shown by standard phenol tests, gives high ability to remove phenolic and similar compounds.

Extreme fineness (99% passing a 325 mesh screen) gives maximum surface exposure and adsorptive capacity.

Controlled, uniform density assures sufficient suspension period to take full advantage of its high adsorptive ability, yet settle out in ordinary settling basins.

The technical and laboratory facilities of this company are available without obligation to those concerned with taste and odor problems in water purification. Your inquiry is invited.

Cliffs Dow

REG. U. S. PAT. OFF.

CLIFFS DOW CHEMICAL COMPANY, Marquette, Michigan

Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Sts., St. Louis; Field Bldg., Chicago

(*Continued from page 28*)

while the hourly wage rate has increased 26 per cent. The automobile industry is one of the greatest users of steel and the car of 10 years ago cost $17.70 per horsepower, whereas today that cost is only $8.45. A comparison of the cars themselves serves to emphasize that today the consumer gets far more for his money than the difference in dollars shows. If you prefer to fly, then note that in 1929 a 3-place open cockpit type airplane cost $7335; now a 5-place cabin type ship can be bought for $5695.

"Gasoline affords another example. We get twice as much gasoline for a dollar as in 1921, when, excluding tax, the price was 31.4 cents per gallon, whereas today on the same basis it is 14.3 cents, and this leaves out of consideration improvement in quality.

"The average coal consumption in central station-generating plants in 1919 was 3.2 pounds per kilowatt-hour. In a decade this was reduced to 1.65 pounds per kilowatt-hour. In 1914 some 220 pounds of coal were consumed per barrel of cement made, but by 1934 this had decreased to about 145 pounds.

(*Continued on page 40*)

46 Years of Leadership

PIONEERS IN METER PROGRESS

THE SYMBOL OF SUSTAINED ACCURACY

YESTERDAY TODAY - TOMORROW

There is a type of Trident Water Meter for every service. Made by modern precision methods. Interchangeable parts protect against obsolescence and depreciation—and protect capital value.

NEPTUNE METER COMPANY

50 West 50th Street (Rockefeller Center), New York City

Neptune Meters, Ltd., 345 Sorauren Avenue, Toronto, Canada

TRIDENT

OVER 6 MILLION TRIDENT & LAMBERT WATER METERS SOLD . . . WORLDWIDE!

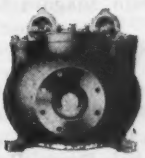
FROST PROOF
with Breakable Bottom
Sizes 5/8″ to 1″

SPLIT CASE
For Frost-free installations
Sizes 5/8″ to 1″

CREST
Velocity or inferential type with turbine or propeller for high rates of flow
Sizes 1½″ and 2″ Screw End
1½″ to 16″ Flange End

Style 3
For medium class service
Sizes 1½″ and 2″ Screw End
1½″ to 6″ Flange End

COMPOUND
For both large and small flows
Sizes 1½″ and 2″ Screw End
1½″ to 10″ Flange End



PROTECTUS
For Fire Service
First to be approved by Underwriters' Laboratories, Inc.
Note clear waterway
Sizes 3″ to 10″

(*Continued from page vi*)

ROBERTS, JAMES MORAN. City Engr., P. O. Box 185, Dublin, Ga.

ROBERTS, WILLIAM H. Commr. of Public Works, 54 Court St., Rochester, N. Y.

RUNYON, GEORGE O. Draftsman, Bureau of Water Works & Supply, Box 240 Arcade Annex, Los Angeles, Calif.

SCHWARTZ, M. C. Research Chemist, Louisiana Steam Gen. Corp., Baton Rouge, La.

SHERWOOD, HERBERT P. Sales Engr., 210 So. Clark St., Chicago, Ill.

SYMES, CYRIL B. City Engr., City Hall, Fort William, Ont., Canada.

WILLIAMS, ROY CAMPBELL. Asst. Engr., Room 404, City Hall, Chicago, Ill.

WINTERTON, L. C. Cons. Engr., Pascagoula, Miss.

WYCKOFF, H. A. Prof. of Bact., Dept. of Biology, Georgia School of Technology, Atlanta, Ga.

Reinstatements, April 1 to 30, 1938

TOWNSHIP OF EAST YORK. Works Commission, 443 Sammon Ave., Toronto, Ont., Canada.

GOULD, HARRY W. Supt. Pumping Stations, Water Works Park, Detroit, Mich.

HANNA, DAVID MCLEAN. Supt. of Distribution, 1121 Pelissier St., Windsor, Ont., Canada.

TAYLOR, D. C. Acting Office Mgr., % Windsor Utilities Comm., 2090 Wyandotte St. E., Walkerville, Ont., Canada.

THOMAS, R. ALLEN. Commr. Public Works, City Hall, Winston-Salem, N. C.

VAN METER, ROY O. Chief Water Treatment Plant Operator, Bureau of Water Works & Supply, Box 240 Arcade Annex, Los Angeles, Calif.

WALKER, W. H. Substation 82, Toronto, Ont., Canada.

Resignations, March 1 to April 30, 1938

BIDWELL, A. R. Owner, Bidwell Water Co., Greenville, Plumas Co., Calif.

BRUNKOW, NORMAN F. Struct. Engr., 446 Berryman Drive, Snyder, N. Y.

CATES, R. H. Power Engr., Southern-California-Edison Co., P. O. Box 135, Los Angeles, Calif.

CLARK, H. WESLEY. City Engr., City Hall, Niagara Falls, N. Y.

CRAIG, O. C. Asst. Engr., National Park, Battle Field Park of Manassas, Va.

CURTS, H. J. Deputy City Engr., City Hall, Niagara Falls, N. Y.

FARRER, ARTHUR. Chief Engr., Ballarat Sewerage Authority, Greenville St., Ballarat, Victoria, Australia.

FENGER, J. W. Asst. Operator, Water Dept., 24 Idlewood Place, Hamburg, N. Y.

FINK, G. J. Director of Research, Chicago Chemical Co., 6216 W. 66th Place, Chicago, Ill.

GALE, P. C. Engr. in Charge, Dept. of Water Works, 321 Franklin St., Michigan City, Ind.

GIBLER, FRANK C. 1124 Harlem Blvd., Rockford, Ill.

GIBSON, NORMAN R. Vice Pres., Buffalo Niagara Electric Corp., Electric Bldg., Buffalo, N. Y.

IPAMCO PIPE CORP. 60 East 42nd St., New York, N. Y. (Assoc. M.)

KAISER, L. S. Supt., Bureau of Water, 112 City Hall, Portland, Ore.

LONDO, HAROLD L. Plant Engr., Water Dept., Green Bay, Wis.

MARX, C. D. 357 Kingsley, Palo Alto, Calif.

MCJANNET, WM. L. Provincial Secretary's Dept., Prisons & Reformatories Branch, Parliament Bldgs., Toronto, Ont., Canada.

MERRIMAC CHEMICAL CO. Mr. Justin J. McCarthy, Everett Station, Boston, Mass. (Assoc. M.)

MOON, C. D. Mgr., New Jersey Water Co., 610 Station Ave., Haddon Heights, N. J.

(*Continued on page 34*)

IT EVEN *Looks* THE PART

The Mueller-Columbian Hydrant even *looks* the part it plays in serving dependable protection to the communities it serves. The very exterior appearance makes a deep impression on those who know the arduous conditions with which a hydrant has to cope and the construction details guard against the effect of time, indifferent maintenance, freezing or accidental breakage. The extra large diameter of the hydrant barrel adds to its attractive appearance and yet retains a characteristic sturdiness. The barrel, bonnet and nozzle caps are excellently balanced in grilled design in order to add to the attractiveness of the hydrant as well as give additional strength to these points.

The interior construction backs up the exterior appearance. First--the self-oiling top assures constant lubrication. Second--the safety-flange and coupling confines damage by traffic accidents to two inexpensive parts. Third--large double bronze bushed drain valves assure complete drainage and freedom from freezing. You can be sure that the Mueller-Columbian Hydrant will not only *act* the part--it even *looks* the part.

MUELLER CO., CHATTANOOGA, TENN.

MABBS

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

(*Continued from page 32*)

RITCHIE, HUGH C. City Engr., City Hall, Moose Jaw, Sask., Canada.

ROSENBERG, OSCAR V. Water Treatment Plant Operator, Dept. of Water & Power, 5851 Second Ave., Los Angeles, Calif.

ROSS, AUSTIN C. Asst. Mgr., Worthington Pump & Machinery Corp., Clinton & Roberts Sts., Buffalo, N. Y.

SCHWANHAUSSER, EDWIN J. Mgr., Buffalo Works, Worthington Pump & Machinery Corp., Clinton & Roberts Sts., Buffalo, N. Y.

SCOBEY, FRED C. SR. Irrigation Engr., Irrigation Division, Bureau of Agricultural Eng., Box 180, Berkeley, Calif.

STELWAGON MFG. CO. Mr. C. R. Lyons, Technical Div., 19th Street & Washington Ave., Philadelphia, Pa. (Assoc. M.)

SHERRITT, H. G. Dist. Mgr., Public Service Co. of Indiana, Methodist Bldg., Shelbyville, Ind.

STONE, NELSON. Sales Representative, Bethlehem Steel Co., 63 Ruskin Road, Eggertsville, N. Y.

SUTTLE, C. B., JR. American Cyanimid & Chem. Corp., Charlotte, N. C.

SWARTZ, W. E. Secretary-Manager, Public Utilities Commission, Petrolia, Ont., Canada.

UNION WATER METER CO. 33 Hermon St., Worcester, Mass. (Assoc. M.)

U. S. ELECTRICAL MFG. CO. 200 E. Slauson Ave., Los Angeles, Calif. (Assoc. M.)

Deaths, March 1 to April 30, 1938

BRACKEN, PAT. Humble Refining Co., Baytown, Tex.

CHAMPE, GEORGE. Consulting Engr., 1025 Nicholas Bldg., Toledo, O.

CLAUSON, HENRY A. San. Engr., Chicago Plumbing Contractors Ass'n., 176 W. Adams St., Room 827, Chicago, Ill.

FELIX, GEORGE H. Ex. Pres., Reading Board of Water Commrs., Retired, 138 N. 9th Street, Reading, Pa.

FLEMING, DAVID H. Cons. Engr., 125 Ranleigh Ave., Toronto, Ont., Canada.

GRUNSKY, C. E. JR. Gen. Supt., East Bay Municipal Utility District, 512–16th Street, Oakland, Calif.

MALMROS, CHARLES, JR. Supt. of Water, Highland Park, Middlesex County, N. J.

MELTON, J. P. Manager of Water Works, Ashland, Va.

RICHARDSON, W. J. Water Supt., 176 So. Batavia Street, Orange, Calif.

WALKER, ISSAC S. Consulting Engineer, 1208 Harrison St., Philadelphia, Pa.

Transfers Beween Sections, April 1 to 30, 1938

PROVOST, ANDREW J. From New York to New England.

STONE, WYMAN R. From South America to New York.

APPLICATION FOR MEMBERSHIP
IN THE
AMERICAN WATER WORKS ASSOCIATION
22 East 40th Street, New York, N. Y.

Date:.....

.....hereby make application for
(I or We)

.....
(Active, Junior, Corporate or Associate Membership, or Affiliate)

in the American Water Works Association, and enclose herewith the sum of $....., one year's dues in advance.

Name.....

Company or Department.....

Title or Position.....

Address.....

.....

If application is for Junior Membership, give date of birth.....

If application is for Affiliate, state number of active services in property where employed .....

Nature of business or character of work (for office records).....

.....

.....

.....

.....

.....

.....

.....

.....

If application is for Corporate or Associate Membership, it must be signed by the person designated to represent the firm or corporation in A.W.W.A. activities.

.....
Signature of Applicant

(over)

ARTICLE I OF BY-LAWS

Section 3. An Active Member shall be a superintendent, a manager, an official or employee of a municipal or private water works; a civil, mechanical hydraulic, or sanitary engineer, a chemist, a bacteriologist, or any qualified person engaged or interested in the advancement of knowledge relating to water supplies. (Annual Dues, $10.00.)

Section 4. A Corporate Member shall be a Water Board, Water Commission, Water Department, Water Company or Corporation, National, State or District Board of Health, or other body, corporation or organization engaged or interested in water supply work, and shall be entitled to one representative whose name shall appear on the roll of members, and who shall have all the rights and privileges of an Active Member. This representative may be changed at the convenience and pleasure of the Corporate Member on written notice to the Secretary. (Annual Dues, $15.00.)

Section 5. An Associate Member shall be either a person, firm or corporation engaged in manufacturing or furnishing supplies for the operation, construction, or maintenance of water works. (Annual Dues, $25.00.)

Section 6. A Junior Member shall be an employee of a municipal or private water works; a civil, mechanical, hydraulic, or sanitary engineer, a chemist, a bacteriologist, a student or any otherwise qualified person engaged or interested in the advancement of knowledge relating to water supplies. At the time of his admission he shall be not less than eighteen years of age. His connection with the Association shall cease when he becomes twenty-five years of age, unless he is regularly enrolled as a student in a university or has previously transferred to the grade of Active Member. Junior Members shall receive the Journal and all privileges of Active membership except holding office and voting. (Annual Dues, $5.00.)

Section 7. An affiliate shall be any person otherwise qualified for Active membership who, at the time of application, is not nor previously has been a member of the Association and who, for acceptable reasons, does not wish to become an Active Member.

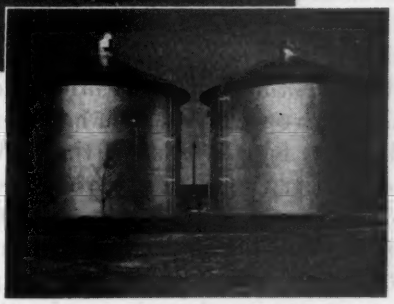
No corporation, firm or partnership which otherwise would be entitled to the grades of Associate or Corporate member may hold the grade of Affiliate. No employee of an Associate member may become an Affiliate. No person who is the superintendent, the manager, the chief engineer, the superintendent of filtration, the chief chemist, or the superintendent of distribution in a plant having more than 3,000 active services, is eligible for the grade of Affiliate. Under unusual conditions, exception to the above may be made by action of the Executive Committee if the applicant sets forth fully the reasons for the exception when applying for the Affiliate grade.

Affiliates shall not be entitled to vote upon general Association questions, and not eligible to hold office in the Association, nor in any of its Divisions. They shall be eligible to vote upon Section questions and to hold Section offices except those of Chairman, Vice-Chairman, Secretary (and/or Treasurer). They shall be entitled to all other rights and privileges of Active Members. Affiliates receive the March, June, September and December issues of the Journal each year. (Annual Dues, $4.00.)

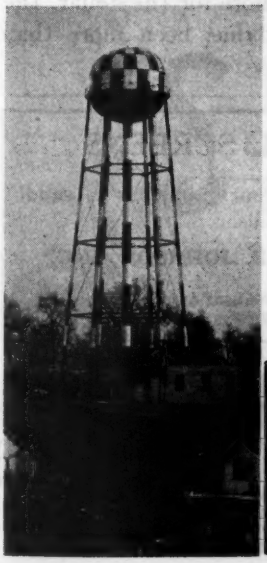
Memberships will be dated as of the beginning of the quarter in which the application is received.

Membership in the Association carries, also with no additional dues, membership in its Local Sections and National Divisions, and includes the Journal, a monthly publication devoted to water works interest. The proceedings of the annual conventions and of the meetings of the Local Sections are published in the Journal, which also contains contributed articles on subjects pertaining to public water supplies.

P·DM 500,000 gallon Double Ellipsoidal Tank, City of Hays, Kansas. High water line 119' above foundation tops.



P·DM Steel Reservoirs, City of Atlantic, Iowa, Capacity 100,000 gallons each; 30' in diameter, 21' high.



P·DM 150,000 gallon Double Ellipsoidal Tank, North Kansas City, Missouri. High water line 142' above foundation tops.

ELEVATED
or
GROUND STORAGE
P.DM TANKS

are designed and built to meet our specific requirementsy

Elevated or ground storage of water, depending upon the nature of the location, is a necessary feature of any modern economically-operated water system. P·DM's engineers can readily determine the type and quantity of water storage your community requires—and assist in the solution of every other question relating to improvement of your service.

P·DM Elevated Steel Tanks provide uniform pressures . . . ample supply at peak demand . . . supply during interruptions in pumping . . . lower pumping costs . . . low plant investment . . . low cost, dependable fire protection . . . good service for outlying districts.

P·DM Steel Reservoirs, located at sufficient elevation, provide the foregoing advantages, plus the following superiorities over reservoirs built of other materials: Permanently water-tight; good for a lifetime . . . lower in first cost than any other type of construction . . . frostproof; can't crack from ground action . . . always new-looking with occasional coat of paint . . . guaranteed in design, workmanship and materials.

We invite you to use P·DM'S free engineering consultation service in any way you desire. There is no obligation of any kind—we're glad to help you!

P·DM ON THE JOB

Send for P·DM's completely illustrated descriptive Bulletins Nos. 101—"Modern Water Storage in Elevated Steel Tanks," and 102—"Standpipes and Steel Reservoirs."

PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, PA. 3424 NEVILLE ISLAND
DES MOINES, IA. 925 TUTTLE STREET

NEW YORK . . . . . ROOM 921-99, 270 BROADWAY
CHICAGO . . . 1228 FIRST NATIONAL BANK BUILDING
DALLAS . . . . . 1229 PRAETORIAN BUILDING
SAN FRANCISCO . . . . . 631 RIALTO BUILDING

(*Continued from page 30*)

"Coming to the chemical field, the prices of viscose rayon yarn have decreased from $2.00 per pound in 1926 to about 50 cents per pound, with the quality immeasurably better. The price of fixed nitrogen in the form of nitrate of soda is about half that of 15 years ago, and there has been a great increase in consumption. Neoprene, produced for some time at costs considerably in excess of the selling price, was introduced at $1.05 per pound and is now around 75 cents. The price history of cellophane is one of 18 successive reductions, starting at $2.65 a pound in 1924 and coming down to 41.5 cents in 1937. Natural camphor imported from the Far East reached $3.75 a pound in 1918. This encouraged research and ultimate success in the production of synthetic camphor with prices below 30 cents a pound.

"In the 10-year period 1927–37 the following items decreased in the amounts indicated: acetic acid, 100 pounds, from $3.38 to $2.43; ammonia, 7.5 to 4.5 cents per pound; ammonium sulfate, $2.38 to $1.37 per 100 pounds; borax, $90 to $49.67 per ton; chlorine, $4.00 to 2.15 per 100 pounds; formaldehyde, 10.33 to 5.75 cents per pound; methanol, 67.5 to 33 cents per gallon; phenol, 17.5 to 13.25 cents per pound; and trisodium phosphate, $3.50 to $2.10 per 100 pounds.

"This sort of data could be continued in many other lines of activity and is certain to be most impressive where research has been adequately supported under capable direction for a reasonable time. We believe it is a good record on behalf of industry, operating in what has been known as the American way. For the benefit of those who think there may be some better way of managing, this may be interesting:—during the period that business has been substantially reducing the price of products and services to consumers, offering better goods and more for the dollar, the aggregate government cost per capita since 1913 has been more than quadrupled."

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.
Lawrenceburg — Indiana

WELL SCREENS

To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.

2304 Long Avenue,
St. Paul, Minn.

SAVE 80% ON YOUR TRENCHING COSTS WITH A
GIANT PIPE PUSHER

10 DIFFERENT SIZES
TO FILL EVERY NEED
WRITE FOR CATALOG
Dept. P-3
GIANT MFG. CO.
Council Bluffs, Iowa

POMONA PUMPS
WATER LUBRICATED TURBINE
POMONA PUMP CO.
POMONA, CALIFORNIA
LOS ANGELES 608 S. MAIN ST. CHICAGO 549 W. JACKSON BLD.
Oceans of Water

A Branch Connection While the Water Flows

QUICKLY, easily, safely, a 30" branch connection can be cut into a 30" or larger main by the use of a Smith Tapping Machine while the water in the main flows merrily along under its usual full head of pressure.

Shut-downs are avoided. They are unnecessary. Expense is saved. Danger is avoided. Health is protected.

This machine is power-operated. It uses an air-motor which supplies a smooth, steady flow of power which enables it to cut through the hardest main in less than an hour.

Other sizes of Smith Tapping Machines will make branch connections from 2" to 42" into any size mains not smaller in diameter than the connection desired.

Smith Tapping Machines are standard equipment today in the water and gas fields.

Send for full details

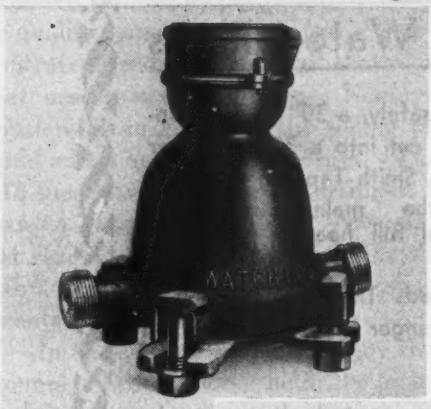
SMITH TAPPING MACHINES

The A. P. Smith Manufacturing Company
East Orange, New Jersey

Smith Tapping Machines—Tapping Sleeves and Valves—O'Brien Hydrants—Valve-Inserting Machines—Removable Plugs, Pipe Cutting Machines—Corporation Tapping Machines—Gas Tee-Inserting Machines—Corporation Cocks—Federal Water Meters.

THE A. P. SMITH MFG. CO. EAST ORANGE, N. J.

WATCH DOG METERS



Frost-proof meter

Turbine meter

Investigate these meters

. . . more than 3,500,000 now in use

WHEN looking over your requirements, remember that thousands of municipalities are getting satisfactory low-cost service from Worthington-Gamon Meters.

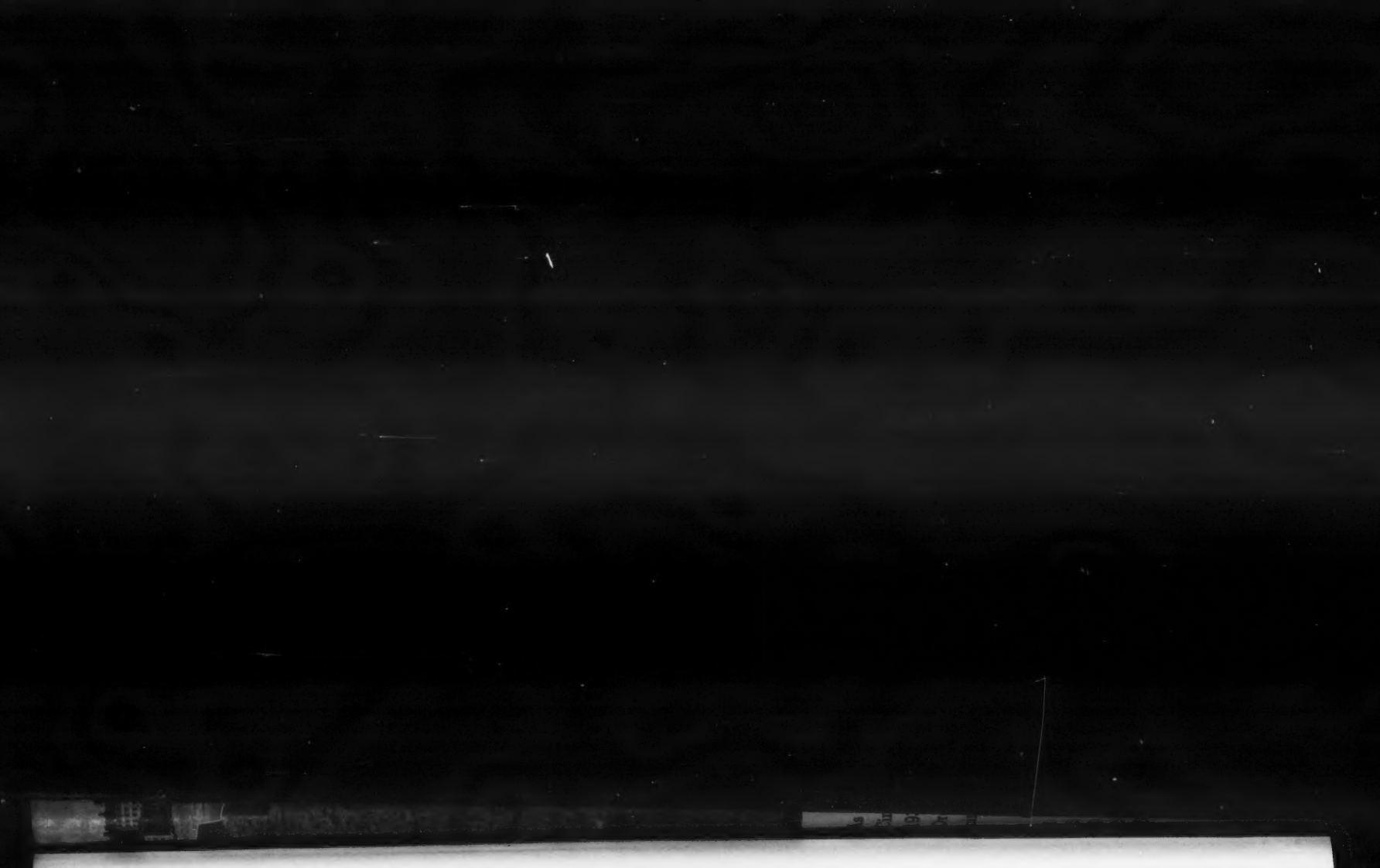
WORTHINGTON-GAMON METER COMPANY

General Offices: HARRISON, NEW JERSEY

Offices and Representatives in Principal Cities

WORTHINGTON-GAMON

WG8-7



Showing installation of 72" I.D. Dresser Couplings on mains between settling and coagulating basins at Cincinnati water purification plant.

Big ones at CINCINNATI!

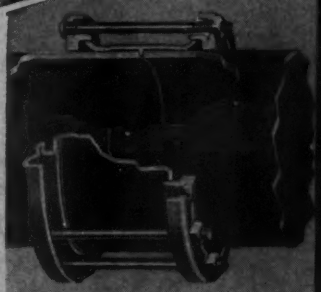
ON LINES OF EVERY SIZE!
Lines of all diameters are being Dresser-coupled in cities like these:
Danville, Ky. Ironwood, Mich.
Ferndale, Wash. New Brunswick, N. J.
Fort Smith, Ark. Ponca City, Okla.

As great in diameter as a six-foot man is tall, are these Cincinnati twin raw-water mains, constructed during 1936 at the water purification plant and joined with Dresser Couplings. A few years before, another Cincinnati water line (48") was also Dresser-coupled.

FIVE REASONS WHY MODERN WATER LINES ARE DRESSER-COUPLED:

1. **PERMANENT TIGHTNESS**—proved for 80 years, on 180,000 miles of pipe
2. **FLEXIBILITY**—normal pipe movements—present in every line—are absorbed
3. **SIMPLICITY**—joint parts are "factory-made"; ordinary labor can install.
4. **STRENGTH**—predetermined; joints safely withstand any specified pressure.
5. **TRUE ECONOMY**—a truly lower joint cost throughout the life of the line.

Write for our General Catalog No. 36.



Cutaway view of Dresser Style 38 Coupling, showing working principle. Note that plain-end pipe is used. The resilient gaskets, flexing with the pipe, safely absorb pipe movements.

THE MODERN TREND IS TO DRESSER COUPLINGS

S. R. DRESSER MFG. COMPANY, BRADFORD, PA. • *In Canada:* Dresser Mfg. Company, Ltd., 60 Front St., W., Toronto, Ont.

LEADITE

Jointed for . . . Permanence with LEADITE

Generally speaking, most Water Mains are buried beneath the Earth's surface, to be forgotten,—they are to a large extent, laid for permanency. Not only must the pipe itself be dependable and long lived,—but the joints also must be tight, flexible, and long lived,—else leaky joints are apt to cause the great expense of digging up well-paved streets, beautiful parks and estates, etc.

Thus the "jointing material" used for bell and spigot Water Mains MUST BE GOOD,—MUST BE DEPENDABLE,—and that is just why so many Engineers, Water Works Men and Contractors aim to PLAY ABSOLUTELY SAFE, by specifying and using LEADITE.

Time has proven that LEADITE not only makes a tight, durable joint,—but that it improves with age.

The pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%

THE LEADITE COMPANY
Girard Trust Co. Bldg. Philadelphia, Pa.

No Caulking

Enid

CHANGES IN MEMBERSHIP

New Members, Applications Received May 1 to 31, 1938

Active

ARLEDGE, JNO. L. Supt. Water Works, Box 326, Hattiesburg, Miss.

BLEZARD, JOHN W. Supt. Water Works, Box 115, Kimberley, B. C., Canada.

BRIGGS, O. L. SR. Supt. of Water, Waynesville, N. C.

BROCK, GEORGE. Supt. Water Dept., Bellingham, Washington.

BROWNSTEAD, J. P. Supt. Water Works, 921 Prospect Place, Ashland, Ky.

BRUHN, ALFRED H. Engr. of Water Purification, % The American Consulate, Bogota, Columbia, S. A.

CAMPBELL, M. S. Asst. Public Health Engr., 1412 Smith Tower, Seattle, Washington.

CARTER, ISAAC NEWTON. Assoc. Prof. of Civil Engr., University of Idaho, Moscow, Idaho.

COOK, WILL W. Advisory Engr., 546 No. 79th St., Seattle, Wash.

CRABILL, E. F. Supt. Board of Public Works, City Hall, Niles, Mich.

CULLER, PAUL D. Supt. Water Dept., Cocoa, Florida.

DICKSON, W. K. Civil Engr., 119 Circle Ave., Charlotte, N. C.

DUNBAR, CHAS. A. City Engr. & Supt. of Water Works, Valdosta, Ga.

EVERY, ELMER D. Pres., Artesian Well & Equip. Co., Rochelle Park, N. J.

GOSNEY, B. C. Supt. City Water Dept., Auburn, Wash.

HOLMES, ALFRED PHILIP HANBY. M.C., B.Sc., A.M.I.C.E., Water Engineer, Municipality, Penang, Straits Settlements.

LANGSTON, J. A. Manufacturer's Agent, 311½ Zack St., Tampa, Fla.

LANSFORD, PAUL T. Pres., Lansford & Co., Room 966, 208 So. LaSalle St., Chicago, Ill.

McLURE, J. H. City Engr., City Water Works, Chester, S. C.

MILLARD, AUGUST B. 8303 Colesville Road, Apt. 393, Silver Springs, Md.

MOFFAT, H. A. % Industrial Chemical Sales Co., 205 W. Wacker Drive, Chicago, Ill.

SAINE, L. P. Repr., Central Foundry Co., 4511 French Ave., Jacksonville, Fla.

SHENINGER, WILLIAM A. Supt. Water Dept., Cor. N. & E. Blvds., Alpha, N. J.

STEWART, R. J. Operating Engr., Edgewood Arsenal, Edgewood, Md.

SYDOW, WILLIAM. Cons. Engr., 3461 Main Highway, Miami, Fla.

VANCE, L. S. Chief Engr. & Supt., Louisville Water Co., 435-3rd St., Louisville, Ky.

WALL, JAMES S. Supt. Water Works, Box 234, Huntsville, Ala.

WALTER, FRED. Mtce. Foreman, 5234 Somerset St., Detroit, Mich.

WISE, WM. H. Topographical Draftsman, Dept. of Water & Power, Bureau of Water Works & Supply, Box 240, Arcade Annex, Los Angeles, Calif.

POFFENROTH, PETER B. Supt. Water Dept., City Hall, Endicott, Wash.

Junior

WISE, WILLIAM R. 2003 Johnstone St., Newberry, S. C.

Affiliate

BUNKER, H. K. Supt., Water & Sewage Dept., Chewelah, Wash.

SCHOOLCRAFT, DAN. Water Works Engr., Muscatatuck Colony, Butlerville, Ind.

Corporate

HAWAIIAN PINEAPPLE CO. LTD. Dr. E. F. Cornell, Asst. Plant Mgr., Honolulu, Hawaii.

(*Continued on page 34*)

NEWS OF THE FIELD

Let's think some more about A.W.W.A. specifications. This association is bringing to completion new specifications for gate valves and hydrants. It has recently adopted specifications for laying cast iron pipe. It has coöperated in the development of the new specifications for cast iron pipe—almost completed now. It is about to engage in a revision of the meter specifications.

But it is time to do some solid thinking about these matters. Members of the A.W.W.A. can labor in preparing specifications. Manufacturers of equipment can coöperate by revising their production methods to step up to the new standards. But every bit of such effort is wasted if the buyers of water works equipment and the planning engineers do not recognize the validity of the specifications and use them.

This needs to be kept in mind—A.W.W.A. specifications are basic. They are really minimum standards. That simply means that the weights, or thicknesses, or physical strength figures given are assumed to be the reasonable minimum for safety. Any water works engineer is entitled to write his own additions to the minimum figures if he feels that he needs more weight or greater strength. But the man who writes down the specifications is flying in the face of fate. He is taking unnecessary chances with the security of the water users in his community.

The man who buys something represented to be "just-as-good-as" the A.W.W.A. specified material, when he knows that it does not come up to the specification, endangers his own professional reputation and endangers the citizens who depend upon him to protect their lives and property.

Stop kidding yourselves. The committees on water works practice can put in extra hours of work for your benefit. Your headquarters staff can do everything possible to get standards and specifications into your hands. But they mean mighty little, if you as an engineer or buyer follow the just-as-good-as substitute method of installing equipment.

The Accounting Manual has been sent to the printer. This association is indebted to the Municipal Finance Officers Association for its planning of the enterprise and for having obtained the funds needed to finance the editorial work.

The Association is also indebted to its Finance and Accounting Division for its enthusiastic coöperation in study of the text as it has been developed and for the intelligent discussion of the material as it approached final form. To Hal Smith of Detroit goes credit for properly appraising

(*Continued on page 2*)

(*Continued from page 1*)

the value of the idea as it was first presented to him by De Berard of Chicago and Chatters of the M.F.O.A. To Blum, Hoffman, Murdoch, Alfke, Swartz, and other leaders in the Finance and Accounting Division goes credit for much hard work in building the text into its final form. To the twenty-one section representatives goes credit for careful study of the first outline of the text.

Members of the A.W.W.A.—especially the Finance and Accounting Division—have become well acquainted with the competent Carl Chatters, Executive Director of the Municipal Finance Officers Association. In his work for that organization, Chatters had come to realize that this oldest and most widespread public utility activity, in the majority of cases under municipal management, was suffering the lack of a well planned accounting manual. He secured the funds to pay for its preparation.

Incidentally, it should interest water works men (and be especially informative to that far-larger-than-reasonable group who do not give a thought to what it costs to do a worth while job) that the cost of developing the manual has been about $10,000.

Now the job is ready for the printer and by early autumn it will be ready for sale. It will approach 400 pages in size and will sell for about $4.00. The exact price and publication date will be announced in a later issue of this Journal. When it is off the press, it will be up to the men in the field to buy it and use it. It is definitely intended to meet the needs of any water department whether the ownership be private or public. The fundamental routine and accounting procedure in either case is the same. The manual is not dogmatic. It does not attempt to set out rules from which no one should deviate. But it does set out reasonable and useful procedures and if a water works accounting department does not use it, it should be prepared to give good reasons why it does not.

This is another place when the individual water works manager and accountant needs to rise above his own direct field. Water works men need guidance and unification. Many water works plants are justly criticized because of their inadequate accounting procedure. Now they have an opportunity to get their accounting house in order—let us fervently hope they will do it.

The Waste Avoidance Committee of the Illinois Central Railroad has issued a memorandum on saving electric current and lamps which is worthy of reference in many water works plants. The average useful life of an electric lamp is 1,000 hours. Unnecessary burning of lamps causes a three-fold waste. It shortens the life of the lamp. It increases labor costs

(*Continued on page 4*)

Nothing takes the place of the

PULLEY

Nothing takes the place of

CAST IRON PIPE

NOTHING serves the purpose so well as the *pulley*—nothing meets all the requirements of an efficient long-lived underground main so well as *cast iron pipe.* Both have been engineering standbys for centuries. Nothing takes their place.

If you demand *proved* long life and low maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—and permanently tight joints—then you will agree that *nothing takes the place of cast iron pipe.* Some materials meet some of these requirements but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE

The Standard Material Q *for Underground Mains*

(*Continued from page 2*)

for replacement. It increases the bills for current. Using the wrong voltage lamp destroys the filament or gives insufficient light. The use of 100 and 150 watt lamps when the 25 and 40 watt lamps will give enough light is wasteful. Rough handling of globes is careless sabotage and is inexcusable.

Any large water department can afford to buy a footcandle meter and study its plants for lighting adequacy—using the current minimum standards of the lighting industry as a guide concerning the amount of illumination actually required.

The United States will reach its population peak within fifty years with a maximum of approximately 158,000,000 according to a report to the National Resources Committee from its Committee on Population Problems made public on July sixth. After this peak is reached, unless growth is accelerated by a changed immigration policy, a period of slow population decrease is predicted. The report "Problems of a Changing Population" deals with the human resources of the Nation in the same broad and comprehensive manner that our natural resources were treated in the 1934 report of the National Resources Committee.

(*Continued on page 6*)

OVER 500 municipalities use American or New York Continental Jewell Water purification equipment.

WATER FILTERS
WATER SOFTENERS

Proportionate Electro-Magnetic Chemical feeders for feeding lime, acid, alum, soda ash, etc.

AMERICAN WATER SOFTENER COMPANY
Lehigh Avenue and 4th St.
Philadelphia, Pa.

Your
Bell and Spigot Main is no Safer or Stronger than its JOINTS!

Leaking joints mean expense for tearing up streets, traffic delays and hazards which none welcomes • Lay your mains to *stay laid* • Get tight, trouble-free and economical jointing with Tegul-MINERALEAD—the ingot-form, quick sealing, sulphur base compound • Tegul-MINERALEAD offers you advantages not to be had in any other jointing compound • Write for complete information.

The ATLAS MINERAL Products Company *of Pennsylvania*
Mertztown
Pennsylvania

Tegul
A Tegul PRODUCT
MINERALEAD
QUICK SEALING for Bell & Spigot Mains

PRECIPITATOR AND FILTER IN ONE!

In Permutit's Spaulding Precipitator

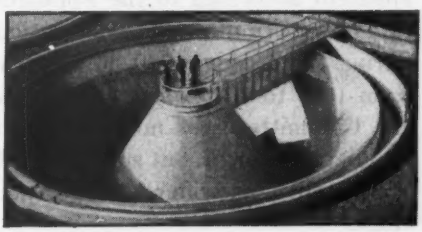
New development revolutionizes Cold Lime Treatment!

Permutit's Spaulding Precipitator is the consummation of many developments in cold lime soda water softening. It permits shorter retention time than ever before, smaller space—and gives more efficient performance. Its truly revolutionary feature is the hydraulic suspension of old precipitates which serve as a filter to produce a clear effluent. This is an exclusive advantage.

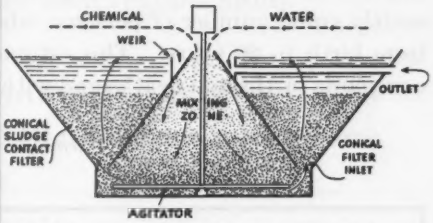
The Spaulding Precipitator consists of two compartments—(a) Mixing Zone, and (b) Conical Upflow Sludge Contact Filter. Chemicals and raw water enter the mixing zone. Here agitators mix the newly forming precipitates with retained older sludge of controlled density—for 30 or 40 minutes. No settling takes place! This feature is *exclusive* with the Spaulding Precipitator.

In ordinary settling basins, sludge settles from water before full reaction occurs. To overcome this, practice has been to return deposited sludge. But this may give the treated water bad taste and odor. In the Spaulding Precipitator, however, *the sludge is kept suspended.* This speeds up precipitation, keeps sludge fresh, cuts down the amount of chemicals needed. Softening is thus completed without putrefaction. Often the treated water is so well stabilized that recarbonation is unnecessary.

OPERATION: After passing through the Mixing Zone, the water is introduced to the Conical Filter uniformly along the periphery of the narrow opening at the bottom. Sludge density is the same in both mixing and filter zones. The agitator's upward thrust, plus the upflowing water's rate of flow keeps a contact filter of conditioned sludge particles



The Spaulding Precipitator during construction, Springfield, Illinois. This is now in operation.



Typical arrangement of Spaulding Precipitator.

suspended in the conical compartment. The conical shape of this compartment also makes the sludge-filter uniformly dense throughout. The top level of this sludge-filter is determined by the rising water's rate of flow.

The mixed water, rising upward, passes through the contact sludge filter. This scrubs or filters out the finer precipitates in the rising water, and leaves the effluent remarkably clear.

As sludge concentrates, it is blown off at a rate set to maintain the correct density of retained sludge.

THESE RESULTS are obtained every day—in practical operation, in both large and small plants. It may also be used for coagulation of turbid or colored waters where lime softening is not required. Would you like more information about this interesting development? Write for free, authoritative booklet on the Spaulding Precipitator to: The Permutit Company, Dept. G2, 330 West 42nd Street, New York, N. Y.

PERMUTIT THE WATER CONDITIONING HEADQUARTERS **OVER 25 YEARS**

(*Continued from page 4*)

With a population of 158,000,000 within fifty years set as a maximum the Committee also gives a minimum estimate putting the population peak at 139,000,000 in 1955 with a decrease of 10,000,000 during the following quarter century. The signs of change in population trends are already apparent according to the Population Committee, which found that the rate of growth during the depression was only half of that which occurred during the decade, 1920–30. It was also found that the rate of increase from 1920 to 1930 was lower than in any preceding decade. In general, the Committee sees no cause for alarm in the impending cessation of population growth, but suggests that the anticipated trend during the next half century may offer an opportunity for working out better human relations.

Changes in age distribution is accompanying the trend in total population. The report estimates that in 40 years there will be an approximately equal number of persons—about two million—at each year of age from birth to 60 years. This estimate is based on medium assumptions as regards births and deaths and with no allowance for immigration. It is

(*Continued on page 8*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2″ to 84″

Flanged Pipe ***Flexible Joint Pipe***

Bell and Spigot Pipe

Special Castings ***Short Body B. & S. Specials***

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

In case the Good News hasn't reached *you:*

ACTIVATED ALUM is a new type alum—9 molecules of water, instead of 18—and 7 to 9% of colloidal siliceous material, to speed up floc formation.

BLACK ALUM is made with standard activated Alum and it costs no more than regular alum.

No less than 125 communities have switched to Activated Alum and Black Alum within one year . . . among them:

Akron, O.	Hamilton, Ont.	Southern Pines, N. C.
Batavia, N. Y.	Hopkinsville, Ky.	Trenton, N. J.
Cambridge, O.	Laurel, Md.	Villa Grove, Ill.
Cleveland, O.	Morrisville, Pa.	Watertown, N. Y.
East Liverpool, O	Newport News, Va.	Weldon, N. C.
Fort Myers, Fla.	Norfolk, Va.	Wellsville, N. Y.
Fredericksburg, Va.	Poughkeepsie, N. Y.	Wilkinsburg, Pa.
Gastonia, N. C.	St. Augustine, Fla.	Wilmington, N. C.
Hagerstown, Md.	Sarasota, Fla.	Youngstown, O.

Samples and quotations? Certainly!
Write for them today.

ACTIVATED ALUM CORP.

AN INDEPENDENT ALUM COMPANY

OFFICE
80 Broad Street
New York City, N. Y.

WORKS
Curtis Bay
Baltimore, Maryland

"When you Think of ALUM--*Think of* ACTIVATED"

(*Continued from page 6*)

predicted there will be a smaller number of persons at the later ages but they will form a much larger proportion of the total than at present. "The birth rate has been declining for many decades," says the report. "The total number of births per year reached a peak in the years 1921–25. Since then there has been a general trend toward decrease in the number of births each year. "Furthermore, there will be a peak in the number of young persons of marriageable age (about 20 years after the peak in the number of births already mentioned) about 1945. Therefore after the middle of the century further decrease must be expected in the number of births each year unless present trends in fertility are reversed or unless the population is augmented by heavy immigration."

Discussing the effect on the Nation of a transition from an increasing to a stationary population the report says: "It may on the whole be beneficial rather than injurious to the life of the Nation. It insures the continuance of a favorable ratio of population to natural resources in the United States. Each citizen of this country will continue to have, on the average, a larger amount of arable land, minerals and other natural resources at his disposal than the citizen of any of the countries of the Old World. This

(*Continued on page 10*)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

Hand Operated—size 2″, 2½″, 3″, 4″
Power Operated—size 3″ and 4″
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

THE ANSWER TO A PROBLEM

ALCO PIPE FOR CHICAGO

Cities using ALCO STEEL PIPE include the following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W Va
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y
New Brunswick, N.J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

The Water Department of Chicago and the Chicago Union Station were jointly and seriously concerned about the material to use in the 36" line to replace pipe running under the tracks of the station. The answer, illustrated above, is Alco Electric Welded Steel Pipe. No further need to worry about disastrous breaks.

ALCO FEATURES

Greater Strength
Longer Life
Smoother Waterway
Longer Lengths
Fewer Field Joints
Low Initial Cost
Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS DIVISION
30 Church Street • New York, N. Y.
CHICAGO WASHINGTON PITTSBURGH HOUSTON TULSA
Plants at Dunkirk, N. Y., and Montreal, Canada
Cable Address: Alproducts.

AMERICAN LOCOMOTIVE COMPANY

But Valueless for Water Purification

Although the diamond is carbon in its most valuable form, it is worthless compared to CLIFFCHAR ACTIVATED CARBON for water purification.

Leading municipalities place high value on CLIFFCHAR to remove objectionable taste and odors from water supply.

CLIFFCHAR "R"

Special Grade for Water Purification

Low phenol value, shown by standard phenol tests, gives high ability to remove phenolic and similar compounds.

Extreme fineness (99% passing a 325 mesh screen) gives maximum surface exposure and adsorptive capacity.

Controlled, uniform density assures sufficient suspension period to take full advantage of its high adsorptive ability, yet settle out in ordinary settling basins.

The technical and laboratory facilities of this company are available without obligation to those concerned with taste and odor problems in water purification. Your inquiry is invited.

Cliffs Dow

REG. U. S. PAT. OFF.

CLIFFS DOW CHEMICAL COMPANY, Marquette, Michigan

Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Sts., St. Louis; Field Bldg., Chicago

(*Continued from page 8*)

supplies the material basis for a high level of living, if these resources are used wisely and if cultural conditions are stimulating to initiative and coöperative endeavor."

A most striking feature of the population shift predicted for the next few decades is the increase in the number of older workers relative to the number of younger adults. Between 1935 and 1975 the estimated increase in the number of persons 20–44 years of age amounts to only six per cent, whereas an increase of 69 per cent is expected in the number of persons 45–64 years. An analysis of the age distribution of workers in different industries shows that occupations which have been declining hold older workers but that the personnel of new industries is heavily weighed with young people. "These findings" the Committee holds, "suggest the importance to national economic and individual morale of greater consideration of conditions affecting the employment of older workers and of provisions for retaining and increasing the adaptability of individual workers displaced from their usual occupations by technological change.

"Problems relating to the welfare of persons past middle life are becoming increasingly urgent. In addition to provisions for insurance and

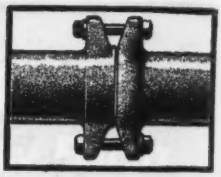
(*Continued on page 12*)

"ENAMELINE" is the trade name for a three-coat lining applied to the interior surface of Mono-Cast pipe and fittings. The first two coats consist of a special mortar made up of Portland Cement mixed with clean silica sand, and the third coat is an asphalt paint. It is offered as an alternate for standard tar coating—at no extra cost—and is recommended for water main service throughout the United States except in very special cases where additional thickness of lining would seem to be desirable.

AMERICAN CAST IRON PIPE COMPANY

New York City Chicago **BIRMINGHAM, ALABAMA** Kansas City Minneapolis
Dallas Los Angeles San Francisco Pittsburgh Cleveland

UNIVERSAL CAST IRON PIPE
LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

THE CENTRAL FOUNDRY COMPANY
General Offices: 386 FOURTH AVENUE, NEW YORK
CHICAGO, ILL., 1105 W. 36th St. - OAKLAND, CALIF., 278 Fourth St.
OFFICES IN PRINCIPAL CITIES COAST TO COAST

(*Continued from page 10*)

other old age benefits, attention should be given to conditions affecting opportunities for and conditions of employment of older workers not ready for retirement. "There should be consideration of further possibilities for adult education and other measures for enhancing the usefulness and increasing the joy of persons in later middle and last years of life."

The Committee found that the urban population of the Nation is already so great in relation to the rural population that future growth of cities will be much slower and more uncertain than in the past. It also found that there are great differences in the density of farm population in different parts of the United States, using such significant measures as acres of arable land per capita of farm population and per capita value of farm land. There was found to be a low ratio of natural resources to population in many parts of the Southeast, and the cut-over region in northern Michigan, Wisconsin and Minnesota, and in parts of Arizona and New Mexico. Partly as a result of these inequalities in available resources, there are great regional differences in productivity, income, and level of living. The average value of farm products per male agricultural worker during the middle 20's was only $672 per year in the Southeast in contrast to $1,495 in the rest of the country.

(*Continued on page 14*)

FIRST QUALITY METERS EXCLUSIVELY

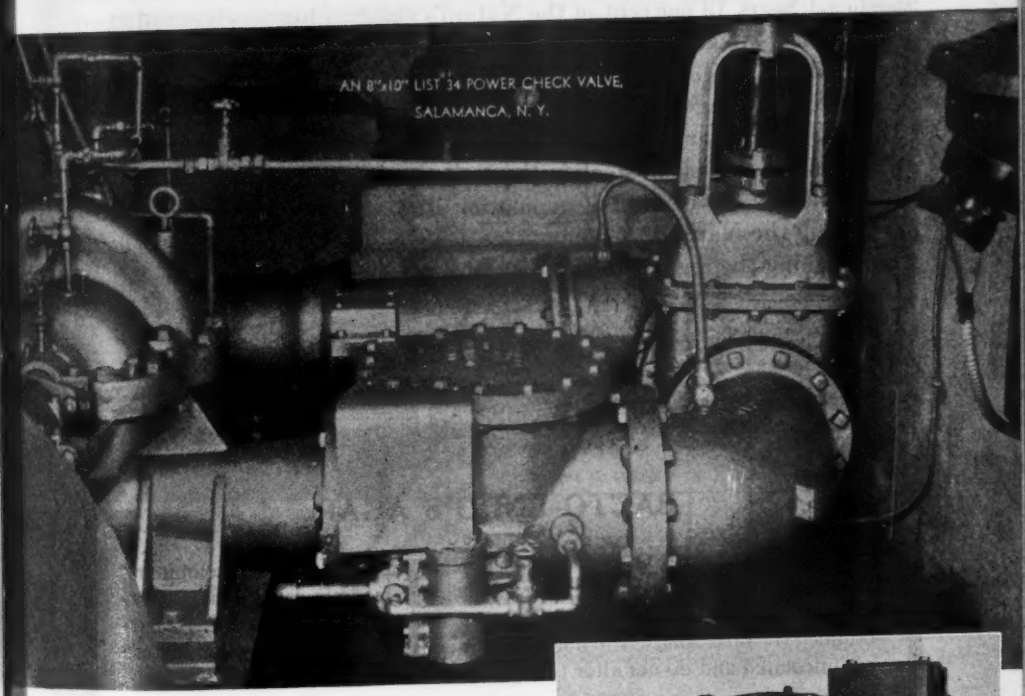
SPECIFY *American* or *Niagara*
(BRONZE CASE) (IRON CASE)
Water Meters
WRITE FOR CATALOG

BUFFALO METER COMPANY
Established 1892 2914 Main St., Buffalo, N. Y.

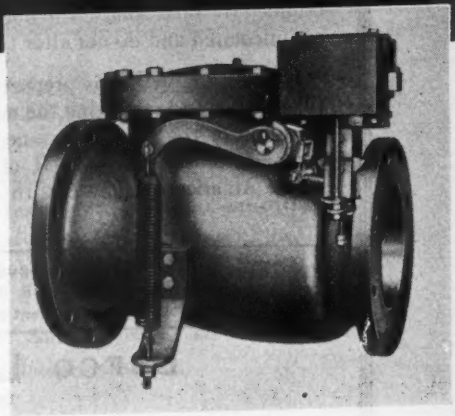
FOR QUIET CLOSURE & MAXIMUM EFFICIENCY—INSTALL

RENSSELAER

LIST 34 POWER CHECK VALVES



AN 8"x10" LIST 34 POWER CHECK VALVE,
SALAMANCA, N. Y.



- **Positively eliminates slam on pump shut-down.**
- **Full clearway opening reduces head loss and cuts power costs.**
- **Simplicity of design and rugged construction results in trouble-free operation over a period of years.**

Bulletin "V" mailed on request

RENSSELAER VALVE COMPANY, TROY, N. Y.

(*Continued from page 12*)

Significant is the fact that the highest ratios of children to adults are found in the poorest areas. In the counties classified as having the lowest material level of living there were 77 per cent more children living in 1930 than would suffice to replace their parents. This is contrasted with an average deficit of 17 per cent in the reproduction rate of counties with the highest level of living. This tendency, the Committee holds, makes it impossible for children in the poorer areas to enjoy equal educational opportunities. As an example, the Committee cites the fact that the Southeast bears 13 per cent of the Nation's children but receives only two per cent of the Nation's income. In the country as a whole, the Committee found the white and Negro groups are now reproducing at about the same rates, making allowance for the higher death rates among Negroes. Contrary to popular impression, the American Indians are now the most rapidly increasing racial stock in the United States.

In view of the bearing of population studies on many major problems now facing the Nation, the committee asserts that there is great need for strengthening the regular research agencies dealing with population statis-

(*Continued on page 16*)

DIFCO

BACTO-ENDO'S AGAR

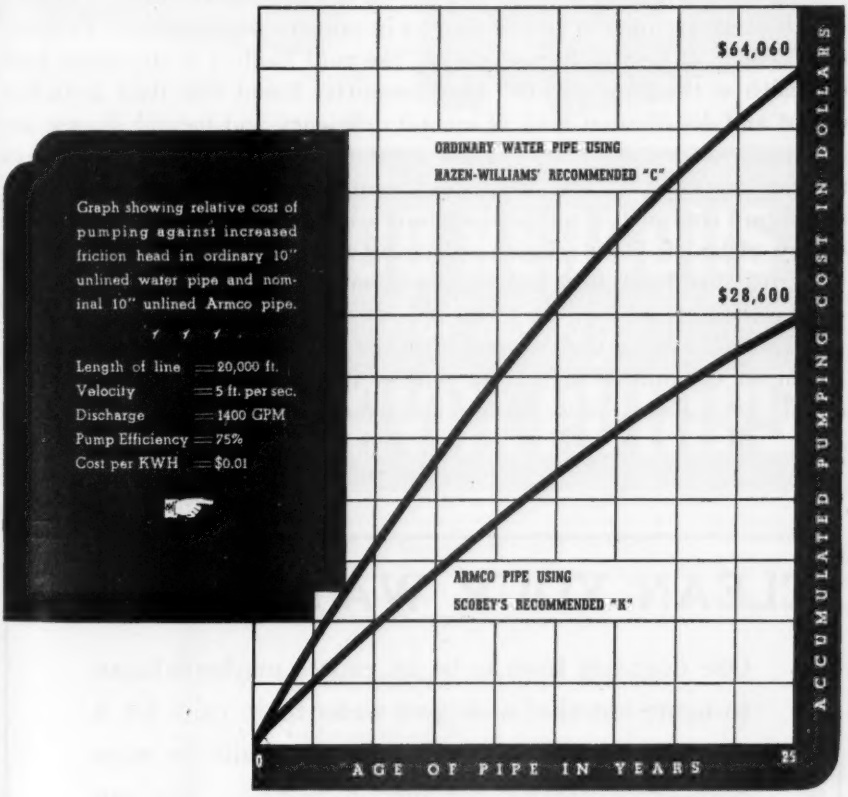
Bacto-Endo's Agar is a widely used plate medium for the preliminary isolation of coliform bacteria in water. On this medium colonies of *Escherichia coli* are red and possess a brilliant metallic sheen, the colonies are surrounded by a red zone. Colonies of organisms which do not ferment lactose are uncolored and do not alter the appearance of the medium.

Bacto-Endo's Agar is prepared for use by dissolving the powder in distilled water and sterilizing the medium. No adjustment of reaction and no filtration of the solution are necessary. The formula of the medium corresponds to the Formula II of "Standard Methods of Water Analysis" of the American Public Health Association.

Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

DIFCO LABORATORIES
INCORPORATED
DETROIT, MICHIGAN

$35,460 SAVED
IN PUMPING COSTS ALONE!


Graph showing relative cost of pumping against increased friction head in ordinary 10" unlined water pipe and nominal 10" unlined Armco pipe.
Length of line = 20,000 ft.
Velocity = 5 ft. per sec.
Discharge = 1400 GPM
Pump Efficiency = 75%
Cost per KWH = $0.01
$64,060
ORDINARY WATER PIPE USING HAZEN-WILLIAMS' RECOMMENDED "C"
$28,600
ARMCO PIPE USING SCOBEY'S RECOMMENDED "K"
ACCUMULATED PUMPING COST IN DOLLARS
0
AGE OF PIPE IN YEARS
25

• Here is an actual cost study showing how much Armco Spiral Welded Pipe will save in pumping costs alone under the conditions set forth above.

Using Scobey coefficients for *unlined* Armco pipe and Hazen-Williams coefficients for commonly used water pipe, the total estimated pumping cost at the end of 25 years would be $28,600 and $64,060 respectively. In other words, to deliver 1400 GPM for 25 years, it would cost *$35,460 less* with Armco Spiral Welded Pipe.

While this estimated saving naturally varies under different conditions, it always is in favor of Armco Pipe. Let us show you how much it would be on your job. The American Rolling Mill Co., Pipe Sales Division, 451 Curtis Street, Middletown, Ohio.

ARMCO ARMCO **SPIRAL WELDED PIPE**

(*Continued from page 14*)

tics, especially the Population and Research Divisions of the Bureau of the Census, and the Division of Farm Population and Rural Life. With more than half the occupied hospital beds in the United States now assigned to patients suffering from nervous and mental diseases, the Committee recommends extensive mental health surveys in sample communities. Terming the problem of mental disease one of "the most baffling in the entire field of health at the present time" the Committee found that data as to the extent and distribution both of mental deficiency and mental disease are extremely meager and it is to supply accurate information that the surveys are recommended. "The problem of mental illness," says the report "is sometimes confused in public discussion with the problem of mental deficiency, although little relation exists between them. Present evidence indicates that hereditary factors play a most important rôle in causing mental deficiency."

In transmitting the Population report to the President the National Resources Committee said: "In general and without endorsement of all details, we commend these findings and recommendations to the considera-

(*Continued on page 18*)

CLEAN YOUR WATER MAINS

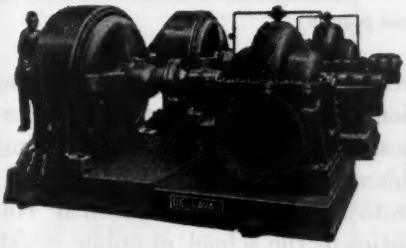
One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

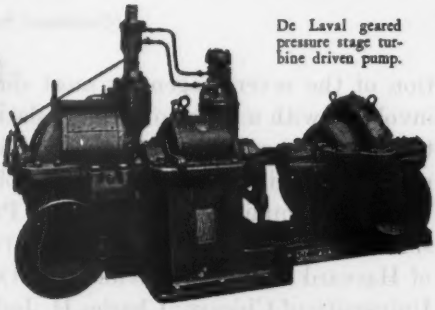
50 Church St., New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.



De Laval motor driven pumps, 12,500 g.p.m., each against 55 ft. at 875 r.p.m.



De Laval geared pressure stage turbine driven pump.

4 GOOD REASONS *for using* DE LAVAL PUMPS

1. DE LAVAL PUMPS ARE INITIALLY EFFICIENT

Because of the use of labyrinth wearing rings, high efficiency is obtained without resorting to undesirably close running clearances. Correct hydraulic design saves power.

2. DE LAVAL PUMPS RETAIN THEIR EFFICIENCY

The labyrinth wearing rings sustain the efficiency much longer than do flat wearing surfaces.

3. DE LAVAL PUMPS HAVE LOW MAINTENANCE EXPENSE

Only materials that are most suitable and of the best quality are used in their construction. The horizontally split casings make all parts easily accessible without disturbing piping connections. All parts are interchangeable, being made to limit gages, and parts subject to wear, such as wearing rings, shaft sleeves, casing protecting bushings and bearings are readily replaced by new parts, without fitting.

4. DE LAVAL PUMPS PERFORM AS REPRESENTED

They are fully guaranteed and thoroughly tested for efficiency and head-delivery characteristics and for perfect mechanical operation.

●

DE LAVAL STEAM TURBINE CO.

TRENTON, N. J.

(*Continued from page 16*)

tion of the several agencies most directly concerned with the problems involved, with a view to such legislation as may be appropriate; and, further, to the consideration of the American people in shaping broad national policies regarding our population problems."

The Committee on Population Problems consisted of: Edwin B. Wilson, chairman, professor of vital statistics in the school of public health of Harvard University; William F. Ogburn, professor of sociology in the University of Chicago; Charles H. Judd, head of the department of education in the University of Chicago; Warren S. Thompson, director of the Scripps Foundation for Research in Population Problems at Miami University; David L. Edsall, M.D., dean of the medical school, of the school of public health and of the faculty of dentistry, *emeritus*, of Harvard University, and Lewis C. Gray, economist in charge of the division of land economics of the United States Bureau of Agricultural Economics, and past director of the land section of the National Resources Committee. The technical staff was under the direction of Frank Lorimer, secretary of the Population Association of America.

(*Continued on page 20*)

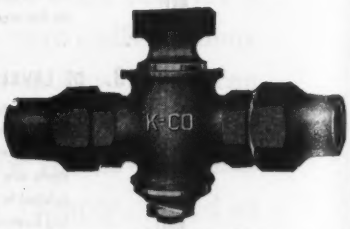
KITSON

FULLY GUARANTEED for freedom from leakage and ease of operation

C-101 Roundway Stop
For Iron Pipe
Tee Handle

C-159 Roundway Stop. Lead Flange Couplings Both Ends

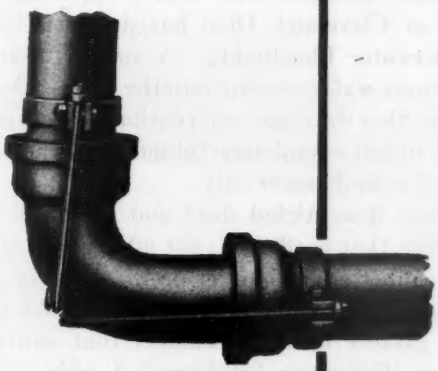
ROUNDWAY STOPS



C-163 Roundway Stop
Copper Pipe Couplings Both Ends

KITSON COMPANY
2409-15 WESTMORELAND STREET
PHILADELPHIA, PA.

Manufacturers of: Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters . . . Quality Brass Goods for Gas, Water and All Plumbing Uses.



Easier to use

The compact design of Grinnell Socket Fittings reduces the size and weight of fittings . . . lessens friction losses.

Savings in installation time and lower materials cost are direct results obtained through this improved design. Connections—even in the most limited spaces are easily accomplished with Grinnell Socket Fittings. Grinnell Company, Inc., Executive Offices, Providence, R. I., Branch offices in principal cities.

SOCKET FITTINGS BY

GRINNELL

...WHENEVER PIPING IS INVOLVED...

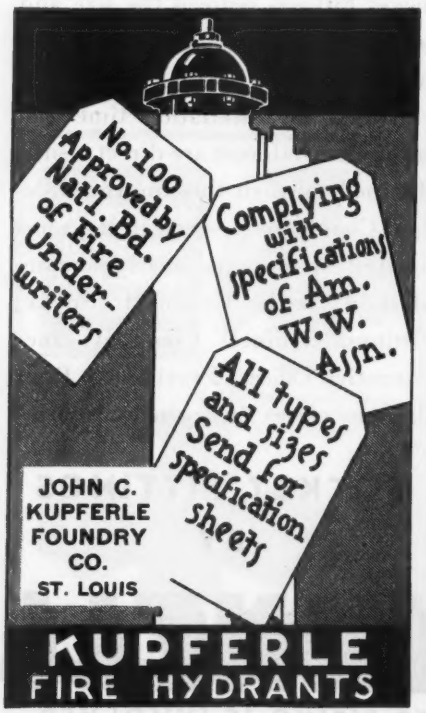
(*Continued from page 18*)

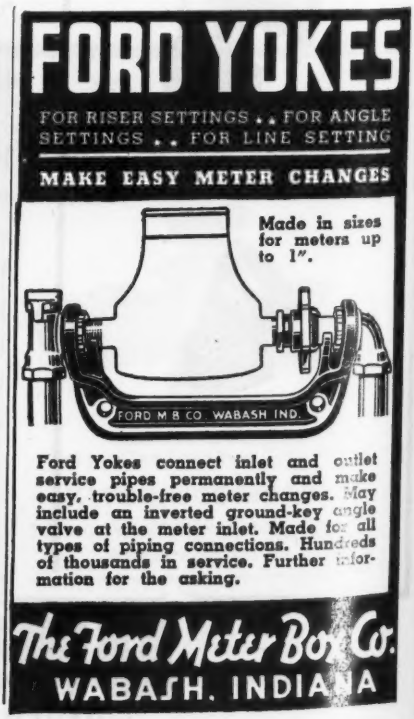
For use in fountains, pools, water falls and other similar applications, Westinghouse Lighting Division at Cleveland, Ohio has designed type CF-14 and CF-16 Aqualux Underwater Floodlights. A special thermo pressure treatment is used to eliminate water seeping into the unit, making a watertight unit which requires neither drainage nor ventilation. Aqualux units should not be operated unless completely submerged in water, and aluminum units should be used in fresh water only.

The aluminum reflector is made from Alclad sheet and is treated by the Alzak process to produce a finish that is efficient, not affected by high temperatures easily cleaned and cannot crack, chip or peel. The convex lens is made of heat-resisting glass. An especially designed door holds the lens between two heavy rubber gaskets in such a manner that uniform pressure is maintained on the lens, eliminating breakage. A wide variation of impressive and beautiful lighting effects may be obtained through different types of control and color lens.

Filter Plant operators who wish to install an underwater light in the clear well should be interested in this new lighting unit.

(*Continued on page 22*)


No. 100 Approved by Nat'l. Bd. of Fire Under-writers
Complying with specifications of Am. W.W. Assn.
All types and sizes Send for specification sheets
JOHN C. KUPFERLE FOUNDRY CO. ST. LOUIS
KUPFERLE
FIRE HYDRANTS


FORD YOKES
FOR RISER SETTINGS . . FOR ANGLE SETTINGS . . FOR LINE SETTING
MAKE EASY METER CHANGES
Made in sizes for meters up to 1".
FORD M B CO. WABASH IND.
Ford Yokes connect inlet and outlet service pipes permanently and make easy, trouble-free meter changes. May include an inverted ground-key angle valve at the meter inlet. Made for all types of piping connections. Hundreds of thousands in service. Further information for the asking.
The Ford Meter Box Co.
WABASH, INDIANA

HERSEY

In this factory we built water meters in the early eighties.

Interchangeable parts for any Hersey Meter ever built are always available from our modern factory.

HERSEY MANUFACTURING COMPANY
SOUTH BOSTON, MASS.
BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS
CHICAGO — SAN FRANCISCO — LOS ANGELES

(*Continued from page 20*)

"**The charge** that an Ashland Patriotic Organization was dominated by our company is one of the many unusual complaints filed against us involving the citizens of Ashland by the S.W.O.C., a C.I.O. affiliate, with the Cincinnati office of the National Labor Relations Board" said C. H. Murray, Assistant to the President of The American Rolling Mill Company, today.

"If this charge is upheld, it means that a Communist, posing as an organizer, can hide behind the skirts of a labor organization. The leaders of any patriotic group who point out his Un-American Record may be taken before a labor board for questioning when charges are filed," Mr. Murray added.

"Though the Labor Board has declined to give us a bill of particulars so we may know what patriotic group was 'Dominated'; the Board's complaint apparently refers to the Clarence Field Post of the American Legion of Ashland.

"Last summer, through a published newspaper statement, the Legion exposed the Communistic Record of George Powers, of McKeesport, Pa.,

(*Continued on page 26*)

The fire hydrant for present-day service and traffic conditions

THE Kennedy SAFETOP meets every requirement of strength, safety and economy as well as instant readiness and reliability in service.

It is strong enough to resist any ordinary impact; but if broken by a collision which *no* hydrant could resist, it is speedily and economically returned to service, without excavation or shutting off the water supply.

Its easy elbow and nozzle curves and its extra-large standpipe assure minimum pressure loss; and its simple, straight-line operating mechanism assures positive operation without danger of sticking.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY
SAFETOP
FIRE HYDRANT

MORRIS KNOWLES, INC.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.
Pittsburgh, Pa.

ALEXANDER POTTER
Consulting Engineer
Specialties: Water Supply and Sewerage
50 Church St. New York City
Telephone 5501 Cortlandt

METCALF & EDDY
Engineers
Charles W. Sherman, Almon L. Fales, Frank A. Marston, John P. Wentworth, Harrison P. Eddy, Jr., Arthur L. Shaw, E. Sherman Chase
Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories Valuations
Boston, Mass. Statler Building **Harrisburg, Pa. Telegraph Building**

CLYDE POTTS
M. Am. Soc. C. E.
Consulting Sanitary Engineer
30 Church Street - - New York
Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

REEVES NEWSOM
Engineer - Consultant
Supply, Purification and Distribution of Water
Operation Design Construction
Valuation Rates Negotiations
Investigations Taxes Accounting
500 Fifth Avenue New York City

SCOFIELD ENGINEERING CO.
Consulting Engineers
Water, Gas, Electric Plants and Distribution Systems
Appraisals, Valuations and Reports
Design—Supervision—Operation
Philadelphia, Penna.

PEASE LABORATORIES, INC.
39 West 38th Street, New York
Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.
Chemists Field Sanitary Surveys
Bacteriologists Consultants

WESTON & SAMPSON
Robert Spurr Weston G. A. Sampson
Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.
14 Beacon St. Boston, Mass.

MALCOLM PIRNIE
Engineer
Water Supply, Treatment, Sewerage,
Reports, Plans, Estimates,
Supervision and Operation
Valuation and Rates.
25 W. 43rd St., New York, N. Y.

WHITMAN, REQUARDT AND SMITH, *Engineers*
Ezra B. Whitman, Gustav J. Requardt, Benjamin L. Smith, Norman D. Kenney, Robert T. Regester, Theodore W. Hacker
WATER WORKS - SEWERAGE - UTILITIES
Baltimore, Md. Albany, N. Y.

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings
50 Church St. New York City

Help Build up Your Association by Bringing in a New Member
SEND FOR APPLICATION BLANK
AMERICAN WATER WORKS ASSOCIATION
22 East 40th St. NEW YORK CITY

(*Continued from page 22*)

who was then C.I.O. Organizer in Ashland. The statement was accompanied by a letter from the Pennsylvania state police, showing that this man had a long prison record, dating back many years before the C.I.O was formed, for offenses ranging from carrying concealed weapons to inciting riots. In a short time Powers succeeded in inciting several strikes and a riot in Ashland, though none of these disturbances occurred in our plant. He was indicted for blocking railroad tracks and obstructing justice.

"In publishing the facts about Powers," Mr. Murray said, "The Legion pointed out that it is, and must be, absolutely neutral in all questions involving labor disputes, but that it was its public duty to notify the community of the presence of a notorious communist in Ashland. To my knowledge, the local Post had never before, and has never since, taken issue with any union organizer. Apparently Powers could not stand publicity, for the C.I.O. transferred him from Ashland immediately afterward. We had heard a great deal about Communism in the C.I.O." Mr. Murray stated, "But we were inclined to doubt it until organizers with communistic records were sent into all three of our plants in three different states. We know the truth, now, through actual experience.

(*Continued on page 28*)

When you choose hydrants, be sure they deliver full flow at all times—eliminate surge and water hammer—break off above the ground, and can be replaced without digging.

Ludlow Hydrants do all that, and combine graceful design with low maintenance costs as well. Send for free folder.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

It makes NO difference to

% PROPORTIONEERS %

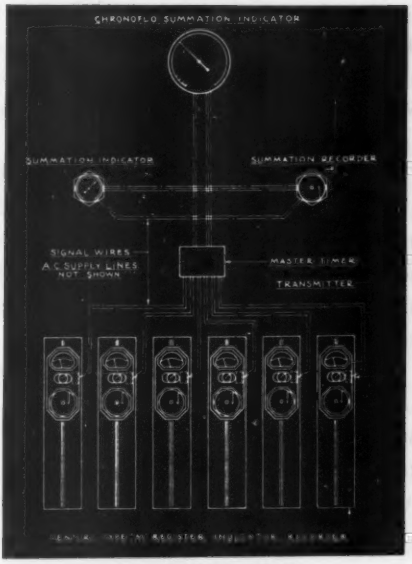
"Perchloron"
"HTH"
"Columbia"
"Wil-Chlor"
"Maxochlor"
"Purex"
"Chlorofectant"
"Chlorox"
"Isco"
"Kohnstamm"
"Clor-O-Mor"

Accurately fed by Chlor-O-Feeders, these chemicals have all been proved practical in chlorinating medium and small water and sewage plants; and even to sterilize big plants in emergencies.

% PROPORTIONERS, Inc. %
18 Codding St., Providence, R.I.

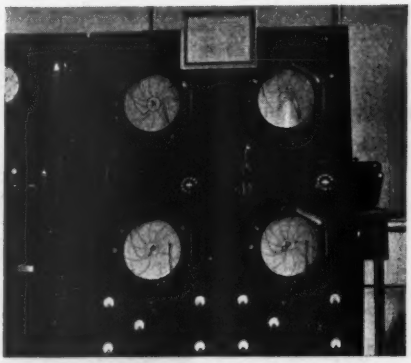
WATCH FOR
ANNOUNCEMENT
OF
ISSUE DATE
AND
PRICE
OF THE
MANUAL OF
WATER WORKS
ACCOUNTING

CHRONOFLO
METER APPLICATIONS



SUMMATION

Totalizing flow through a group of individual meters located any distance apart.



REMOTE CONTROL

Records from distant stations make possible automatic remote control of pressure, level, and flow.

"CHRONOFLO"—Registered U. S. Patent Office

Ask for NEW Bulletin, 298

BUILDERS IRON FOUNDRY
"Builders of Venturi Since 1891"
9 CODDING ST., PROVIDENCE, R. I.

(*Continued from page 26*)

"Last August a man who called himself 'John Steuben' was put in charge of C.I.O. activities at our Butler, Pa., plant. It developed that he had just been indicted for destroying railroad property in the Youngstown, Ohio, riots. While in Butler, he was convicted and fined for his Youngstown offenses—and the C.I.O. paid his fine. It developed also that 'Steuben, was only one of several assumed names. His real name was apparently Itsok Ryshak. He was born in Russia, and was not even a United States citizen. Steuben, or Ryshak, was one of the chief communist organizers in this country, and the author of numerous signed articles in the 'Daily Worker,' official Communist newspaper. In these articles he advocated that Communists join labor unions, 'Bore from within,' and incite revolution. As soon as Steuben's record was made public in Butler, he was removed by the C.I.O.

"Just a few days later," Mr. Murray continued, "The C.I.O. sent T. Louis Majors to Middletown, Ohio, to organize our plant. After he came in conflict with local authorities, his record was investigated. The congressional record disclosed Majors' Communistic connections, and it was further revealed that he had been run out of New Castle, Pa., for spreading

(*Continued on page 30*)

REDUCE YOUR DIESEL PLANT INVESTMENT!

The Sterling Diesel Engine is a masterpiece of engineering simplicity. The first cost, the installation, freight, placement, depreciation, amortization and all the fixed charges are effected—downward.

STERLING HIGH DUTY

Sterling

INTERNAL COMBUSTION ENGINES

135 H.P. continuous, 150 H.P. maximum, 1200 R.P.M. Sterling Diesel Engine, for direct connection to pump or generator. (Michell Patents)

The more you know about Diesels the better can you appreciate this excellent development. Preliminary analysis of costs furnished most promptly when request is accompanied by load characteristics.

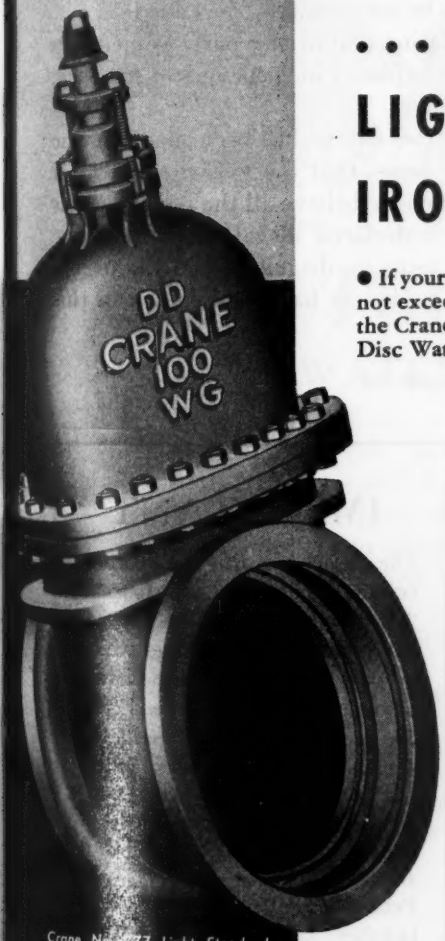
GAS — GASOLINE — DIESEL — ENGINES

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

STERLING ENGINE COMPANY
Dept. C-3

Branch Office
900 Chrysler Bldg.
New York, N. Y.

Don't pay Heavy Valve Premium on 100-pound Systems



Crane No. 777 Light Standard Iron Body Double Disc Gate Valve with hub ends and non-rising stem. Brass trimmed.

IT'S WHAT'S INSIDE THAT COUNTS!

...INSTALL CRANE LIGHT STANDARD IRON BODY VALVES

● If your operating pressure on the water mains does not exceed 100 pounds, it will pay you to look into the Crane No. 777 Light Standard Iron Body Double Disc Waterworks Gate Valves.

Here is a medium-weight valve that has all the needed features of the heavier patterns designed for municipal systems—that gives you the efficiency and durability of a heavier valve, but saves the premium required on heavy valves with pressure ratings in excess of the needs of your system.

It's Crane inside quality in the No. 777's—as in all Crane Valves—that is your assurance of dependable and lasting performance. It's the soundness of Crane engineering through and through, Crane's skill in metallurgy, and a manufacturing experience of more than 80 years that account for better valve behavior wherever Crane valves are installed.

Start an economy program on your valve needs today. Turn to page 107 of your Crane No. 52 Catalog for complete details on Crane No. 777 Light Standard Iron Body Gate Valves. The line is complete—it fills every need of water works, filtration plants, and sewage disposal systems operating at pressures up to 100 pounds.

CRANE

VALVES • FITTINGS • PIPE • PLUMBING • HEATING • PUMPS

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVENUE, CHICAGO

NATION-WIDE SERVICE THROUGH 134 BRANCHES AND MORE THAN 500 WHOLESALERS

(*Continued from page 28*)

Communistic propaganda while acting as a C.I.O. organizer. The C.I.O. immediately transferred him from Middletown. In each of these cases, the exposed Communist threatened an investigation by the Labor Board or some other government agency. This is typical Communist procedure. When they get themselves in trouble, as they always do, they cry for protection from the very Government they have sworn to destroy. We are perfectly willing that any of these cases be investigated," he added.

"If members of the Armco organization played any part, as members of the legion or other patriotic bodies, in exposing such enemies of America, we are proud of them.

"Though we were astounded that this charge has been made by the Labor Board," Mr. Murray said, "We hope, that the C.I.O. will keep it out in the open. It is a question in which we believe all the people of this country are vitally interested. If it is declared illegal for a patriotic organization to point out that a man is using his disguise as a C.I.O. organizer to promote Communism, then we no longer have free speech in this country and we may as well know it."

(*Continued on page 32*)

HELLIGE NON-FADING GLASS COLOR STANDARDS

Available for pH measurements, and all popular water tests—the smallest and lightest in weight, and the most convenient to handle.
Perpetually guaranteed for accuracy ... they include everything that is desirable in color standards.
The same conveniences and permanence are incorporated in the durable HELLIGE COMPARATORS with which they are used.

Bulletin on request

HELLIGE
INCORPORATED
3718 Northern Blvd. Long Island City, N. Y.

IMPORTANT

The Association has run short of certain numbers of the Journal. Any member possessing a copy of any of the following issues which he does not wish to keep should advise this office. We will pay 50¢ each for copies to meet the demands of new members.

May 1930
April 1936
January 1937
February 1937
October 1937
January 1938

IF YOU HAVE A COPY AVAILABLE, JUST DROP US A POST CARD.

American Water Works Association
22 East 40th St., New York

PIONEERS IN METER PROGRESS
YESTERDAY
TODAY
TOMORROW

THE SYMBOL OF SUSTAINED ACCURACY

"I've used thousands of

TRIDENT

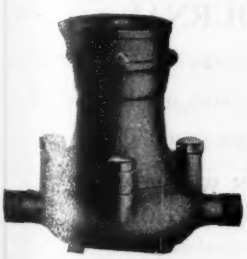
WATER METERS

and I didn't see how Neptune could possibly better them—until I actually went through the shops and saw their modern machine tools, their vastly improved gauges, the closer accuracy and finer finish obtained by today's precision manufacturing methods . . . they're certainly living up to their slogan, 'Pioneers in Meter Progress.'"

NEPTUNE METER CO.

50 West 50th Street (Rockefeller Center)
New York City

NEPTUNE METERS, LTD.
345 Sorauren Avenue, Toronto, Canada



SPLIT CASE
For Frost-free installations
Sizes ⅝" to 1"

CREST
Velocity or inferential type
for high rates of flow
Sizes 1½" and 2" Screw End
1½" to 16" Flange End

COMPOUND
For both large and small flows
Sizes 1½" and 2" Screw End
1½" to 10" Flange End

For maximum water revenue
with the lowest maintenance
for the longest period of time

Investigate **NATIONAL** *Meters*

NATIONAL METER COMPANY, 1207 First Ave., Brooklyn, N. Y.

(*Continued from page 30*)

The National Society for the Prevention of Blindness says that of the eyes injured, 80 per cent suffer from flying bodies, 8 per cent from tools or parts of machinery, 7 per cent from splashing liquids, 2.5 per cent from explosions, 2 per cent from falls, and 0.5 per cent from infections. That eyes can be saved in industry is illustrated by four examples. At the General Electric Co. in Schenectady, N. Y., there were 24.6 eye injuries per 1000 employees in 1918. This was reduced to 0.8 in 1932. At the U. S. Steel Corp. there were 7.3 eye injuries per 1000 employees in 1914 and this has come down to 0.8 in 1932. At one of the eastern coal companies in 1929 there were 24.7 eye injuries per 100 employees. In 1932 this was 2.3. Then the Union Pacific System had 11.7 eye injuries per 10,000 employees in 1926 and by 1933 this had been reduced to 1.9. These figures indicate what can be accomplished by making the most of protection measures which are readily available. The society, at 50 West 50th St., New York, N. Y., now offers at a special price of $0.50 its handbook on "Eye Hazards in Industrial Occupations" which formerly sold at three times that price.

(*Continued on page 36*)

EVERSON STERILIZING APPARATUS

Feeds, Measures and Mixes Chlorine Gas

A complete line of new and better apparatus for controlling, feeding and mixing chlorine gas, ammonia, etc. into solutions—for sterilizing drinking water, sewage or swimming pools.

Write for Bulletin and Catalog of Swimming pool equipment and Supplies.

EVERSON MANUFACTURING CO.
"The Swimming Pool People"
221 W. Huron St., Chicago, U. S. A.

JOURNAL

If you have any old copies of the Journal you would like to dispose of, see page 30.

AMERICAN WATER WORKS ASSOCIATION

"SUMMERTIME"

Every year during this period, heat waves bring about the usual run of troubles for Mr. Plant Operator.

1. Low water conditions, or actual shortage of raw water.

2. Excessive algae and other organic growths in raw water supplies, resulting in excessive tastes and odors.

3. Reduced turbidity in the water supply, making coagulation difficult and shortening filter runs.

4. Greater increased consumer demand.

This means that the Plant Operator is confronted with his greatest problem during this period and is particularly "pushed" to the limit to furnish a water that is palatable. One means of helping with this problem is the application of AQUA NUCHAR as an aid to better coagulation, and for its all around use as a taste and odor remover.

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

230 Park Avenue, New York, N. Y. — **205 W. Wacker Drive, Chicago, Ill.** — **417 Schofield Bldg., Cleveland, Ohio**

Manufacturers of POWDERED ACTIVATED AQUA NUCHAR CARBON ***Activated Carbon***

MABBS

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

(*Continued from page vi*)

WATER BOARD. Mr. Fred Decker, Supt. of Public Works, Maybrook, N. Y.

BOARD OF WATER COMMISSIONERS. Mr. Edward Ayers, Supt. of Public Works, Montgomery, N. Y.

CITY OF OCALA WATER DEPT. Mr. L. B. McKenzie, Supt. of Water & Light Dept., 512 Orange Ave., Ocala, Fla.

SANTA ANA VALLEY IRRIGATION CO. Mr. L. E. Blakeley, Chief Engr., 154 North Glassell St., Orange, Calif.

BUREAU OF WATER WORKS. Mr. Ralph C. Clyde, City Commr., 115 City Hall, Portland, Ore.

DEPARTMENT OF WATERWORKS. Mr. William Peters, Repr., Valparaiso, Ind.

CITY OF WAITSBURG. Mr. R. R. Rinehart, Water Supt., Waitsburg, Wash.

CITIZENS UTILITIES CO. Mr. F. A. Merfeld, Dist. Mgr., Wallace, Idaho.

Associate

CULLIGAN ZEOLITE CO. Mr. E. J. Culligan, 1895 Shermer Ave., Northbrook, Ill.

Reinstatements (Active)

DEMOYA, P. PAUL. Mgr., Consumer's Water Co., Stuart, Fla.

HALLGREN, R. A. Supt. of Water Dept., Crystal Beach, Ont., Canada.

MOUNTIEN, MILES R. City Chemist, Dept. of Public Health, 914 County Court House, Miami, Fla.

SAUNDERS, WILLIAMS K. Co-Partner, Couse & Saunders, General Contrs., 415 Brainard St., Detroit, Mich.

Reinstatements (Associate)

LAYNE & BOWLER, INC. Mr. J. G. Gordon, Jr., Pres., Memphis, Tenn.

MUELLER BRASS CO. Mr. F. L. Riggin, Sr., Pres. & Gen'l Mgr., Port Huron, Mich.

Resignations, May 1 to 31, 1938

Active

AMES, FRED W. Engineer & Branch Manager, Western Pipe & Steel Co., P. O. Box 824, Phoenix, Ariz.

FOX, FRANK A. Council Bluffs City Water Works, Council Bluffs, Ia.

HENDERSON, JOHN M. Division Engineer, State Board of Health, P. O. Box 344, Brunswick, Ga.

MAGEE, W. G. Supt., Water & Light Dept., P. O. Box 452, Morehead City, N. C.

RUFF, CHARLES F. Brayton Park, Ossining, N. Y.

Associate

GREDAG CORP. Mr. Daniel W. Streeter, Pres., Niagara Falls, N. Y.

JOHNSON MINERAL PRODUCTS CORP. Mr. R. H. Johnston, Pres., 972 Park Place, Brooklyn, N. Y.

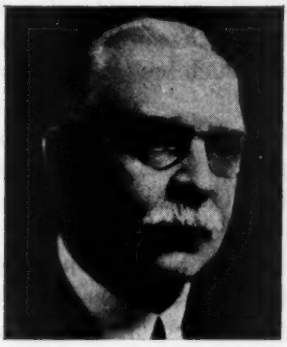
Transfers between Sections

THEODORE HORTON from New York to New England.

T. T. QUIGLEY from New York to Illinois.

WM. L. HOEFLING from New England to New York.

"WE LIKE HTH"



E. C. Sanderson, Commissioner Water and Sewer Department, Town of Winchester, Mass., says:

"We are always very careful to thoroughly sterilize all new mains; we use HTH for this purpose. We have had very satisfactory results from your product."

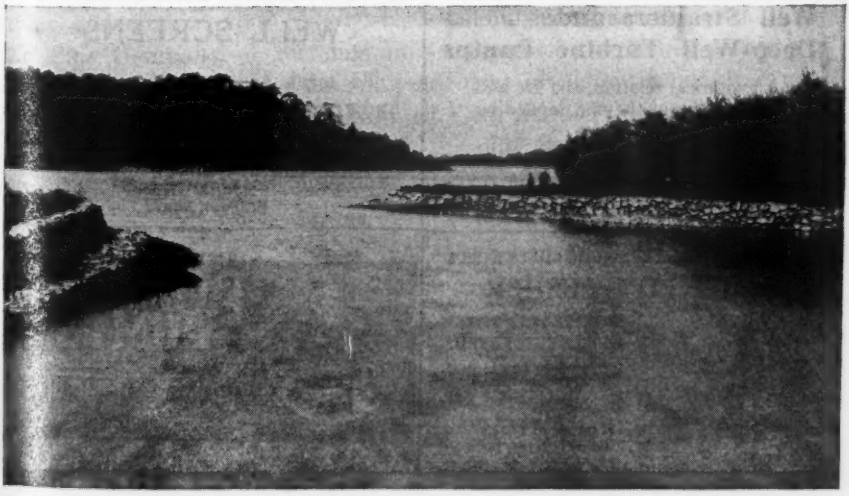
IF anyone thinks the duties of a water department official are easy, let him have a talk with E. C. Sanderson at Winchester, Mass. Even in this small water department, he will learn how many and how diverse are the problems that officials must solve in maintaining a safe and adequate water supply.

Not the least of the problems at Winchester has been the proper sterilizing of new mains. Like hundreds of other water works men throughout the country, Mr. Sanderson uses HTH for this important job with "very satisfactory results".

Sterilization of new mains is just one of the many water treatment jobs that are made to order for HTH. If you have not yet received "Hypo-Chlorination of Water", write today for a copy of this valuable 80-page manual on water treating problems and how to meet them. It's yours for the asking.

The MATHIESON ALKALI WORKS (Inc.)
60 East 42nd Street New York, N. Y.

Soda Ash . . . Liquid Chlorine . . . Bicarbonate of Soda . . . HTH and HTH-15. . . Caustic Soda . . . Bleaching Powder . . . Ammonia, Anhydrous and Aqua . . . PH-Plus (Fused Alkali) . . . Dry Ice (Carbon Dioxide Ice)



(*Continued from page 32*)

The American Cast Iron Pipe Company announces the completion of what is believed to be the first travelling demonstration unit of its kind in the cast iron pipe industry. The manufacturers point out that tremendous advances in the art of manufacturing cast iron pipe and in the design of pipe joints have been made in recent years, and the novel "Acipco Display Truck" is especially-built for use as a travelling demonstration of the improved physical properties as exemplified by Mono-Cast Centrifugal Pipe. The truck is outfitted with samples of pipe, various joints, fittings and other specialties as produced at Acipco, together with descriptive literature and large illustrations of actual installations. The demonstrations lay particular emphasis on special joints which have been developed to meet the demands of super-service, it is stated.

The truck left Birmingham during the latter part of June to carry the story of modern cast iron pipe and fittings by actual demonstrations throughout all sales territories of The American Cast Iron Pipe Company. After a sixty day tour of Oklahoma, Kansas, Nebraska, Missouri and Iowa, the truck will spend thirty days in Minnesota and Wisconsin; approximately sixty days in Michigan, Ohio, Indiana, and Illinois; sixty to seventy-five days in Texas, Arkansas and western Louisiana; and sixty to ninety days in southern territory, principally Tennessee, Mississippi, eastern Louisiana, Alabama, Georgia, Florida, South and North Carolina and Kentucky.

An Acipco representative accompanies the display truck on its tour of his territory, and this representative endeavors to contact every pipe user on the truck's itinerary. The visit of the truck to individual communities is announced by a card mailed several days in advance of the truck's arrival.

(*Continued on page 39*)

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.
Lawrenceburg — Indiana

WELL SCREENS

To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.
2304 Long Avenue,
St. Paul, Minn.

SAVE 80% ON YOUR TRENCHING COSTS WITH A
GIANT PIPE PUSHER

10 DIFFERENT SIZES TO FILL EVERY NEED
WRITE FOR CATALOG
Dept. P-3
GIANT MFG. CO.
Council Bluffs, Iowa

(*Continued from page 36*)

Stream pollution legislation, in the form supported by the A.W.W.A., was passed in the last minutes of the session of Congress. The Vinson bill (of which Senator Barkley was associate sponsor before he became Senate leader) passed with only minor modifications of its original form. But to the surprise and disappointment of industries facing problems of stream pollution, the President pocket vetoed the Vinson bill. Thus came to nothing the three year effort to establish a national policy by which the federal government, through a new Division of Water Pollution Control in the United States Public Health Service, would coöperate with states and municipalities in measures to purify the streams of the country. Proponents of the measure must start all over again in the next session of Congress.

The President's explanatory memorandum did not raise the question of whether control should be exercised by the federal government or by states and communities. This was the issue that held the measure so long in controversy, and which was finally settled by the Senate's acceptance of the House measure for state and local control. The reason advanced for the veto was that the bill provided for direct presentation to Congress by the Secretary of the Treasury of recommendations of the Surgeon General for authorization of specific projects calling for loans or grants-in-aid, and that this runs counter to the fundamental concept of our budget system.

During the hearings upon and discussions of this legislation, practically no comment was made concerning this detail.

It is greatly to be regretted that a secondary aspect of this bill should have been made the reason for nullifying an enactment of constructive value and of fundamental interest to all water supply men.

New lining for Cast Iron Pipe and Fittings which is said to prevent tuberculation, reduce friction of flow, maintain permanently high "C" values, and minimize pumping costs, is announced by the American Cast Iron Pipe Company of Birmingham, Alabama. The lining consists of two coats of cement and a finishing seal coat of asphalt paint; it is centrifugally applied to regular Mono-Cast Centrifugal Pipe, and applied by hand to the fittings. When so lined, the pipe and fittings are marketed under the trade-name "Enameline."

(*Continued on page 40*)

(*Continued from page 39*)

An example of annual report for water works men to consider fully and to imitate as far as fits the needs of their case is found in the "Koppers Yearbook—1938," just published by Koppers Company, Pittsburgh.

"To make clear the financial facts as to one corporation, the balance sheet and profit-and-loss statement of Koppers Company (not including its affiliates) are here presented in terms of a single employe as an individual unit.

"In 1937, this hypothetical individual would sell products and render services to customers, and would receive money from his investments in the form of dividends, and interest, to a total of $6,685. This revenue he would spend as follows:

"For the purchase of raw materials from which his products were made, principally, coal, timber, steel and fire brick; for power and supplies used in his manufacturing operations; for freight on raw materials and finished products; for traveling and other expenses necessary to carry on his business	$4,181
"For taxes paid to local, state and federal governments	181
"For replacements of plants, machinery and equipment no longer useful, and for provisions to take care of anticipated replacements in future years, in order to keep facilities usable—termed by the accountant 'Depreciation and depletion'	178
"For salaries and wages paid to himself for his time and efforts in carrying on the business	1,561
"After these expenditures, the remainder of his receipts would belong to the individual business man and to those others who joined with him in risking the $11,493 capital which was needed to establish and operate the business. Part of this would be paid in the form of interest and dividends to those furnishing the money; part he would retain to expand and develop his business, thereby increasing the investment with the hope of increasing the profits. The total amount available for these purposes, in 1937, would amount to 5.1 per cent of the $11,493, or	$584

Taxes paid in 1937, it is stated, were 75 per cent greater than the total amount paid to stockholders. They were equal to six weeks' wages for each of its 10,029 employes.

Water department reports need to appeal to the citizen who uses the supply. His support is needed when new bond issues are required. Some understanding on his part of what it actually takes to serve him would help to enlist his support.

SHUT the DOOR on the THREE NEEDLESS COSTS!

FRICTION with its extravagant loss of capacity can be minimized.

DETERIORATION with its reduction of strength and of useful life can be avoided.

MAINTENANCE cost with its economic objections can be eliminated.

A Lock Joint Reinforced Concrete Pressure Pipe Line Effectively Closes The Door on These Unnecessary Evils

LOCK JOINT PIPE CO., Est. 1905. AMPERE, N. J.
PRESSURE : : SUBAQUEOUS : : SEWER : : CULVERT

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

AMERICAN WATER WORKS ASSOCIATION

Headquarters Office

22 East 40th St., New York

Officers

President	REEVES NEWSOM Consulting Engineer, 500 Fifth Avenue New York, N. Y
Treasurer	WILLIAM W. BRUSH
Secretary	HARRY E. JORDAN
Assistant Secretary	P. S. WILSON

Board of Directors

Representing the Local Sections

California Section	NELSON A. ECKART, San Francisco, Cal.	to-1939
Canadian Section	ALBERT E. BERRY, Toronto, Ont.	-1940
Central States Section	H. LLOYD NELSON, Philadelphia, Penna.	-1941
Florida Section	A. P. BLACK, Gainesville, Fla.	-1939
Four States Section	CHARLES H. BECKER, Philadelphia, Pa.	-1939
Illinois Section	HAROLD E. BABBITT, Urbana, Ill.	-1939
Indiana Section	H. A. DILL, Richmond, Ind.	-1940
Kentucky-Tennessee Sect.	E. E. JACOBSON, Lexington, Ky.	-1941
Michigan Section	GEORGE H. FENKELL, Detroit, Mich.	-1941
Minnesota Section	LEONARD N. THOMPSON, St. Paul, Minn.	-1939
Missouri Valley Section	EARLE L. WATERMAN, Iowa City, Iowa	-1941
Montana Section	JOSEPH M. SCHMIT, Lewistown, Mont.	-1939
New England Section	ROGER W. ESTY, Danvers, Mass.	-1941
New Jersey Section	SAMUEL F. NEWKIRK, Elizabeth, N. J.	-1941
New York Section	WILLIAM A. MCCAFFREY, Oswego, N. Y.	-1941
North Carolina Section	PAUL W. FRISK, Enka, N. C.	-1940
Pacific Northwest Sect.	MILTON H. MCGUIRE, McMinnville, Oregon	-1941
Rocky Mountain Section	CHESTER A. TRUMAN, Colo. Sprgs., Colo.	-1940
Southeastern Section	J. K. MARQUIS, Spartanburg, S. C.	-1940
Southwest Section	JOHN B. WINDER, Dallas, Texas.	-1939
Virginia Section	MARSDEN C. SMITH, Richmond, Va.	-1940
Wisconsin Section	ARTHUR H. MILLER, Sheboygan, Wis.	-1940

Representing the Water Works Manufacturers Association

Manufacturer	DENIS F. O'BRIEN, East Orange, N. J.	-1939
Manufacturer	WILLARD T. CHEVALIER, New York, N. Y.	-1940
Manufacturer	CLINTON INGLEE, New York, N. Y.	-1941

Ex-Officio Members of the Board

President	REEVES NEWSOM, New York, N. Y.	-1940
Past President	EUGENE F. DUGGER, Newport News, Va.	-1939
Treasurer	WILLIAM W. BRUSH, New York, N. Y.	-1939
Ch. W.W. Practice Comm.	MALCOLM PIRNIE, New York, N. Y.	-1939
Ch. Publication Comm.	LINN H. ENSLOW, New York, N. Y.	-1939

Officers of the Divisions

Finance and Accounting Division.—Chairman, M. F. HOFFMAN; Vice-Chairman, DALE L. MAFFITT; Secretary-Treasurer, WILLIAM J. SCHWARTZ; Directors, JACOB SCHWARTZ, HAL F. SMITH.

Plant Management and Operation Division.—Chairman, THOMAS L. AMISS; Vice-Chairman, A. P. KURANZ; Secretary-Treasurer, D. D. GROSS; Directors, SAMUEL F. NEWKIRK, L. S. VANCE.

Water Purification Division.—Chairman, CHARLES GILMAN HYDE; Vice-Chairman, CHARLES H. SPAULDING; Secretary-Treasurer, CHARLES R. COX; Past Chairman, WILLIAM M. WALLACE; Additional members of Executive Committee, M. C. SMITH, PAUL WEIR.

Lithographed on stone by James E. Allen for U. S. Pipe & Foundry Co. Copyright 1937, U. S. Pipe & Foundry Co.

THIS PIPE LINE was planned for *permanence* and therefore it is built with cast iron pipe, a material known for *long life* in underground service. What if the first cost *is* higher in some cases! Figured against the complete cost of an installation, the extra investment for cast iron pipe is small indeed. Figured against years of service it is soon liquidated, but the *dividends in extra service* continue for generations.

U.S. cast iron PIPE

U. S. PIPE & FOUNDRY CO., BURLINGTON, NEW JERSEY

Foundries and Sales Offices throughout the U. S.

Officers of the Sections

Section	*Chairman*	*Vice-Chairman*	*Secretary-Treasurer*	*Past-Chairman*	*Other Members of the Section Governing Board*[2]
California	J. E. Phillips	H. Reinhardt	C. M. Hoskinson	R. F. Brown	J. R. Barker, G. W. Hawley, J. S. Longwell, F. S. Porter, C. Wilson.
Canadian	A. B. Manson	—	A. E. Berry	E. V. Buchanan	C. E. Brown, L. G. McNeice, R. J. Smith, G. H. Strickland, F. G. Browne, W. Storrie, W. T. Randall.
Central States	E. C. Trax	W. C. Lawrence	E. P. Johnson	R. Hulbert	T. L. Young, E. A. Johnson.
Florida	T. M.Lowe	G. F. Catlett	J. R. Hoy	D. S. Wallace	R. G. Ridgely, G. Kingsley, K. R. Chinn, F. R. Mills, W. B. Gibson
Four States	H M. Freeburn	C. J. Lauter	C. A. Hechmer	E. B. Whitman	I. M. Glace, G. R. Taylor, E. S. Hopkins, A. Wolman.
Illinois	W. D. Gerber	F. G. Gordon	C. W. Klassen	F. C. Amsbary	G. B. Prindle, H. H. Gerstein.
Indiana	P. C. Laux	M. H. Schwartz	J. A. Bruhn	J. L. Ford	C. L. Link.
Kentucky-Tenn.	C. M. McCord	H. Arnold	H. D. Schmidt	E. E. Jacobson	H. C. Bristol, H. N. Jernigan.
Michigan	E. E. Norman	C. R. Bird	M. N. Gerardy	—	O. A. McCarthy, L. E. McQueen, R. J. Faust.
Minnesota	F. Seligman	J. A. Jensen	R. M. Finch	R. A. Thuma	E. M. Grime, A. C. Janzig, C. L. Elliott.
Missouri Valley	D. L. Maffitt	B. L. Ulrich	E. L. Waterman	N. T. Veatch	C. Alexander, C. Hoen, E. R. Mathews, L. M. Nelson, F. A. Rathert.
Montana	G. E. Atkinson	C. W. Eyer	H. B. Foote	R. N. Arnold	D. S. Thomas, Kurt Wiel
New England	S. S. Anthony	F. A. Marston	S. M. Ellsworth	W. J. Scott	H. W. Griswold, P. A. Shaw.
New Jersey	W. R. Conard	G. F. Wieghardt	H. N. Lendall	S. F. Newkirk	J. A. Carr, C. H. Capen.
New York	E. L. H. Meyer	F. Henshaw	R. K. Blanchard	A. D. Drake	C. R. Cox, E. K. Wilson.
North Carolina	J. W. Kellogg	R. A. Thomas	A. R. Hollett	H. G. Baity	G. S. Moore, A. O. True, W. E. Vest.
Pacif. Northwest	N. A. Gilman	T. H. Judd	F. Merryfield	M. H. McGuire	R. E. Koon, M. K. Snyder
Rocky Mountain	O. J. Ripple	—	B. V. Howe	P. S. Fox	K. W. Caldwell, O. B. Summers, B. G. Coy, J. P. Soderstrum, K. F. Darling, L. O. Williams.
Southeastern	C. P. Townsend	P. Weir	B. P. Rice	D. R. Pringle	F. G. Crow, M. G. Stewart, J. H. McLure, H. F. Wiedeman
Southwest	T. L. Amiss	A. R. Davis	L. A. Quigley	H. E. Nunn	R. W. Harding, L. A. Jackson, A. F. Theard, M. T. Vanlandingham.
Virginia	H. B. Rice	H. A. Johnson	H. W. Snidow[1]	A. L. Meisel	E. C. Meredith,[1] C. L. Crockett.
Wisconsin	W. U. Gallaher	W. C. Staeffler	L. A. Smith	C. Gruetzmacher	A. E. Hintz.

[1] Virginia Section—Secretary is H. W. Snidow; Treasurer E. C. Meredith
[2] For Section's representative on the A. W. W. A. Board of Directors, see list on page ii

COMING MEETINGS

Aug. 25–26—Virginia Section, at Hotel Robert E. Lee, Lexington, Va. Secretary, H. W. Snidow, State Dept. of Health, Richmond, Va.

Sept. 12–13—Rocky Mountain Section, at Townsend Hotel, Casper, Wyoming. Secretary, B. V. Howe, State Office Building, Denver, Colo.

Sept. 13–16—New England Water Works Association, at Hotel Statler, Boston, Mass. Secretary, Frank J. Gifford, Statler Building, Boston, Mass.

Sept. 14–16—Michigan Section, at Bancroft Hotel, Saginaw, Mich. Secretary, M. N. Gerardy, Water Board Bldg., Detroit, Mich.

Sept. 22–23—New York Section, at Nelson House, Poughkeepsie, N. Y. Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

Sept. 29–Oct. 1—Minnesota Section, at Hotel Nicollet, Minneapolis, Minn. Secretary, R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

October 6–7— Four States Section, at Raleigh Hotel, Washington, D.C. Secretary, Carl A. Hechmer, Washington Suburban Sanitary District, Hyattsville, Md.

October 10–12—Wisconsin Section, at Plankinton Hotel, Milwaukee, Wis. Secretary, L. A. Smith, City Hall, Madison, Wis.

October 13–15—Missouri Valley Section, at Hotel Fort Des Moines, Des Moines, Iowa. Secretary E. L. Waterman, University of Iowa, Iowa City, Iowa.

October 17–20—Southwest Section, at Hotel Biltmore, Oklahoma City, Okla. Secretary, L. A. Quigley, Supt., City Water Works, Fort Worth, Texas.

October 21–22—New Jersey Section, at Berkeley-Carteret Hotel, Asbury Park, N. J. Secretary, H. N. Lendall, Rutgers University, New Brunswick, N. J.

October 26–29—California Section, at Mission Inn, Riverside, Calif. Secretary, Carl M. Hoskinson, Div. of Water, Sacramento, Calif.

October 31–Nov. 2—North Carolina Section, at King Cotton Hotel, Greensboro, N. C. Secretary, A. R. Hollett, Box 281, Chapel Hill, N. C.

[1] For Section's representative on the A. W. W. A. Board of Directors, see list on page ii

CHANGES IN MEMBERSHIP

New Members, Applications Received June 1 to 30, 1938

Active

BARROW, JOE. Filtration Plant Operator, Municipal Filtration Plant, Gallatin, Tenn.

BROWN, L. V. Z. Sales Engr., Wallace & Tiernan Co. Inc., 3900 Purdue, Dallas, Texas.

CLAPP, W. J. Commercial Representative, Florida Public Service Co., 100 E. Central Ave., Orlando, Fla.

CUNHA, ALVARO. Chief Chemist, Reparticao de Aguas e Esgotos, Alameda Jahu 1844, Sao Paulo, Brazil.

DOW, DOUGLAS. Member, Board of Water Comnrs., 2000 Second Ave., Detroit, Mich.

FINERTY, HUGH P. Trustee, Council Bluffs City Water Works, Council Bluffs, Iowa.

GIDLEY, ALBERT B. Manager, Compton Municipal Water Dept., City Hall, Compton, Calif.

KOHL, LEWIS E. Supt. of Water, Water Works Div., 43 City Hall, Rochester, N. Y.

MCENTEE, HARRY E. Supt. Water Softening Plant, 1215 S. State Street, Ann Arbor, Mich.

PARKS, C. A. Johns Manville Sales Corp., 743 Henry Bldg., Seattle, Wash.

SHANK, S. J. Supt. Water Dept., Escanaba, Mich.

SOMERS, VERNE A. Asst. Supt., City Water Dept., Stevens Point, Wis.

STALEY, H. H. Cons. Engr., 1156 Garfield Ave., Topeka, Kansas.

STARLING, CHARLES H. Sales Engr., International Filter Co., 1314 Rhodes Haverty Bldg., Atlanta, Ga.

TASCHEREAU, T. A. Engineer, Room 5, Adams Block, Kalispell, Mont.

TITUS, ROBERT L. Topographical Draftsman, Bureau of Water Works & Supply, Box 240 Arcade Annex, Los Angeles, Calif.

WALKER, JOSEPH H. Plant Chemist, Louisville Cement Co., Speed, Ind.

WIGHTMAN, F. C. Town Manager, Town of Kentville, Nova Scotia.

Affiliate

SETZLER, G. V. Supt. Water & Sewers, P. O. Box 213, Saluda, S. C.

Associate

THE DUNLAP CO., Mr. Homer C. Dunlap, Pres., Oklahoma City, Okla.

Reinstatements (Active)

RICE, CYRUS WM. Pres., Cyrus Wm. Rice & Co., Inc., Highland Building, Pittsburgh, Pa.

New Members, Applications Received April 24 to 28, 1938
Membership Effective July 1, 1938

Active

BRINKMAN, CARLYLE K. Cons. Engr., Gante #11, Mexico, D. F., Mexico.

CROCKER, J. R. Dist. Mgr., Permutit Co., 523 B.M.A. Bldg., Kansas City, Mo.

DILL, W. N. Mgr., Mueller Co., Pacific Coast Factory, 2801 East 12th St., Los Angeles, Calif.

(*Continued on page 34*)

NEWS OF THE FIELD

"Make your cities safer" is the advice of Reeves Newsom, President of this association, when asked how public water supply officials could benefit most from the Recovery Relief appropriations.

There are hundreds of water plants over the country where there is great need for more valves in the distribution mains of the systems. Plenty of valves will protect a city against interruption of supply over a large area if a flood, an earthquake, or traffic conditions cause a pipe line to break. Especially in time of fire it is vital that the water mains and the supply be in good order. A break in mains affecting a large area may cause a water shortage at a fire and result in a major conflagration.

Again, how many times have we heard of the home that burned because no water main or hydrant was close enough to furnish water to put out the fire. A program of water main extensions, or of hydrant additions, makes a worth-while water works W.P.A. project.

Another way to make cities safe is to have a survey made of the condition of the plumbing in public and office buildings, and hotels. A lot has been learned since the Chicago amoebic dysentery epidemic of 1933, and we know now that while a water department or company may do a good job and deliver to the customer's property a perfectly safe water, ignorance or failure to carry on proper maintenance may permit unsafe plumbing fixtures and piping arrangements in large buildings to cause serious illness of people who use water in them.

There are other ways that cities can be made safer but these examples should illustrate the fact that water authorities can benefit from the recovery funds and the communities reap full value for the expenditures made. No city should delay making proper application to the P.W.A. or W.P.A. authorities if water needs are evident.

Are you a water department superintendent, interested in telling your public some useful facts about department operations? "Reporting to Employees on Company Operations" is the title of a brochure recently issued by the Policyholder's Service Bureau of the Metropolitan Life Insurance Company. Any water department superintendent or manager who wishes to study a copy may have it for the asking. In it will be found a fine series of examples of reports to employees from such concerns as the Jewel Tea Company, Johns-Manville Corporation, York Ice Machinery Corporation, Illinois Central Railroad, Elgin Watch Company, and many others. The beauty of the document is that following the examples

(Continued on page 2)

(*Continued from page 1*)

in this booklet and the use of a bit of imagination, the story of water plant financial operations can be told in terms that bring the facts home to every water user and prospective bond-voter.

Turn again to the leading article in the May issue of this Journal—"The Water Works Executive and His Community." Read it carefully. Does it not suggest the need for intelligent planning of water department reports so that they have qualities that will make the citizens read them? Perhaps the booklet on reporting to employees will help.

During the past few years some cities have attempted to economize by reducing the amount of money spent in the maintenance and operation of water departments. But such a policy does not necessarily mean that real savings will accrue to a city, for neglected water plants and distribution systems may require needlessly costly overhauling in the future because of such neglect.

Besides jeopardizing a city's investment in its water plant, failure to provide adequate funds for maintenance and operation may have other undesirable consequences. If a city becomes niggardly in the purchase and use of purifying materials, the water delivered to rate payers often is of unsatisfactory quality. Such a policy of unsound economy may expose the city's population to the dangers of unwholesome water conditions. If savings are attempted by maintaining salaries or wages at too low a level, skilled and experienced workers are not attracted, and the operation of the water plant, so vital to the health and well being of the citizens, is below par.

The per capita cost of water in a municipality is not in itself a measure of the efficiency of the water department. Some cities whose per capita expenditures for maintenance and operation of the water department average around $1 a year point to that apparently low cost, as compared with costs in other cities that run more than $2 per year per capita. But such comparisons may mean little or nothing. No city should begin to boast of its water rates until the state or national health authorities certify the supply to be a safe one; nor until the fire insurance rating is of the highest class; nor until the water department employes are known to be selected for fitness and protected by a pension system, nor until an adequate cash reserve is on hand to care for unforseen emergencies. Not until these requirements are satisfactorily met is any city or its officials in a position to talk about its water rates being low. Too often low water rates involve curtailment of necessary and proper expenses. Unwise curtailment of any service, especially that of water, is false economy.

(*Continued on page 4*)

Nothing takes the place of an

ACORN

Nothing takes the place of

CAST IRON PIPE

OAK TREES grow from acorns—and *nothing else.* The vast system of cast iron underground mains in America is the outgrowth of a water main constructed in France 274 years ago with cast iron pipe and still in service. *Nothing else,* before or since, has demonstrated equal economy and long life as a material for underground mains.

If you want proved long life and low maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—and permanently tight joints—then you will agree that *nothing takes the place of cast iron pipe.* Some materials meet some of these requirements but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE

The Standard Material Q *for Underground Mains*

(*Continued from page 2*)

"**The Effect of City Water and Sewerage Facilities** on Industrial Markets" (Market Research Series, No. 17) is a publication of the U. S. Department of Commerce which should be on the desk of every water works engineer, equipment manufacturer, city planner, and chamber of commerce in every U. S. city.

Primarily directed toward the effect of air-conditioning demands upon water supply facilities in U. S. cities of 20,000 and over, the survey indicates the per cent of increased demand that various parts of a water system are prepared to meet.

Divided into five headings—water sources, storage capacity, treatment capacity, pumping capacity, and mains—the survey discloses that many cities are out of balance. In some, source of supply lags, in others —pumping equipment, in many—distribution mains limit delivery of available supply. Since water departments are assumed to be interested in the sale of water and equipment manufacturers are likewise assumed to be interested in making such sales possible, department managers and equipment engineers can take counsel with each other, to the end that water supply facilities be made adequate and brought into balance.

(*Continued on page 6*)

TAKES THE GRIEF OUT
of BELL & SPIGOT JOINTING

THINK—of quick-sealing joints • that permit back-filling to be started right away • that aren't worried by vibration • THINK—of a compound that can be used by unskilled labor • in a form never bothered by rain or flood • a form that can be stacked and stored outdoors, in any weather • THINK of having no more worries about composition changes due to shake-down in transit • THINK of all these advantages, and remember—*they're all yours* in

A Tegul PRODUCT

Tegul

MINERALEAD

For more information, write

The ATLAS MINERAL Products Company
of Pennsylvania
Mertztown . . . . Pennsylvania

IMPORTANT

The Association has run short of certain numbers of the Journal. Any member possessing a copy of any of the following issues which he does not wish to keep should advise this office. We will pay 50¢ each for copies to meet the demands of new members.

May	1930
April	1936
January	1937
February	1937
October	1937
January	1938

IF YOU HAVE A COPY AVAILABLE, JUST DROP US A POST CARD.

American Water Works Association
22 East 40th St., New York

H-10810
Meter Box
Cover

DESIGNED FOR YEARS OF SERVICE

Mueller Extension Service Boxes, Meter Box Cover and Meter Yokes have been designed to give years and years of service. The upper section of the Extension Service Box slides freely up and down in the base, absorbing any heavy shocks to the top or permitting frost heave without damage to the curb stop or water service pipe. The lids are of heavy cast iron and practically indestructible. Made in either Minneapolis or Arch Pattern Base.

Mueller Meter Box Covers have the unique worm type lock that can be opened only with a special key. When the key is turned to open, the worm *forces* the lid open, and in closing, it *pulls* the lid tightly against the cover and prevents entrance of dirt or cold air.

Mueller Meter Yokes are sturdy and compact and may be used with practically all meters. They serve as a permanent pipe fitting, maintaining the spacing and alignment of piping at all times whether the meter is in or out. The stop, elbow and expansion connection are all bronze, giving a full bronze waterway. Specify Mueller Products and get those *extra* years of service.

H-10300
Minneapolis
Pattern

H-10306
Arch
Pattern

H-10840
Meter
Yoke

MUELLER CO.

Decatur, Ill.

THE MORSE FILTER PLANT AT BRISTOL

The Morse Filter Plant is modern, efficient, economical. Built in a series of concentric circles, it forms a compact unit. Every part is accessible for inspection or repair. Constructed of steel throughout, seepage and leakage are eliminated. Designs range from 250,000 gpd to 30,000,000 gpd. The above view shows a 5 m.g.d. plant at Bristol, Conn., recently placed in operation. Write for bulletin describing this modern plant or estimating figures when planning an installation.

CHICAGO BRIDGE & IRON COMPANY

Chicago ..... Old Colony Bldg.
Birmingham ..... 1500 N. 50th Street
Boston ..... Consolidated Gas Bldg.
Cleveland ..... Rockefeller Bldg.
Dallas ..... Liberty Bank Bldg.
Detroit ..... Lafayette Bldg.
Houston ..... 2919 Main Street
Los Angeles ..... Wm. Fox Bldg.
New York ..... 165 Broadway Bldg.
Philadelphia ..... 1700 Walnut Street Bldg.
San Francisco ..... Rialto Bldg.
Tulsa ..... Hunt Bldg.

Plants at BIRMINGHAM, CHICAGO and GREENVILLE, PA.

(*Continued from page 4*)

The Reconstruction Finance Corporation has offered for sale $60,000,000 worth of bonds of the Metropolitan Water District of Southern California. This project will be remembered by A.W.W.A. members as the one which consolidated the future water supply interests of fifteen cities, the largest being Los Angeles. It will be remembered that in February the C.I.O. protested to the R.F.C. that the Metropolitan Water District be given no further federal assistance because, as it was represented, it had spent $50,000 in anti-union activities.

Should cities use revenue from the sale of water to the public to pay salaries of firemen, policemen and for other general administrative purposes?

That is a question that is confronting dozens of cities and towns throughout the United States. Many dollars are diverted annually from water revenue by municipalities, with the result that water rates are often higher than need be, and improper and inadequate financial provision is made for maintenance and extension of water systems. Diversion of water revenue also tends to keep salaries of the department's personnel, whose

(*Continued on page 8*)

In case the Good News hasn't reached *you:*

ACTIVATED ALUM is a new type alum—9 molecules of water, instead of 18—and 7 to 9% of colloidal siliceous material, to speed up floc formation.

BLACK ALUM is made with standard activated Alum and it costs no more than regular alum.

No less than 125 communities have switched to Activated Alum and Black Alum within one year . . . among them:

Akron, O.	Hamilton, Ont.	Southern Pines, N. C.
Batavia, N. Y.	Hopkinsville, Ky	Trenton, N. J.
Cambridge, O.	Laurel, Md.	Villa Grove, Ill.
Cleveland, O.	Morrisville, Pa.	Watertown, N. Y.
East Liverpool, O	Newport News, Va.	Weldon, N. C.
Fort Myers, Fla.	Norfolk, Va.	Wellsville, N. Y.
Fredericksburg, Va.	Poughkeepsie, N. Y.	Wilkinsburg, Pa.
Gastonia, N, C.	St. Augustine, Fla.	Wilmington, N. C.
Hagerstown, Md.	Sarasota, Fla.	Youngstown, O.

Samples and quotations? Certainly!
Write for them today.

ACTIVATED ALUM CORP.

AN INDEPENDENT ALUM COMPANY

OFFICE
80 Broad Street
New York City, N. Y.

WORKS
Curtis Bay
Baltimore, Maryland

"When you Think of ALUM--*Think of* ACTIVATED"

(*Continued from page 6*)

tasks involve a high degree of experience and skill, at levels below those of workers in other city departments.

Although no figures are available showing the total diversions of water revenue to purposes other than water works financing, the annual amount runs into millions of dollars. In New York City, where there recently was a substantial increase in the water rates, diversion of water revenue is reported to exceed $10,000,000 annually. In Wheeling, W. Va., a sizable part of the revenue is used for general administrative purposes. The state Public Service Commission, believing that diversion of water revenue by a city is improper, is striving to have Wheeling stop such diversion. The commission believes that water rates should be reasonable and that sound financing and accounting methods should be followed in the operation of a municipal water plant. The rates, says the commission, should cover operating costs adequately, provide funds for depreciation and replacements, and also cover fully the annual debt requirements. The commission frowns upon policies which fail to make ample provision for those three factors involved in the financing of a municipal water plant.

(*Continued on page 10*)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

Hand Operated—size 2″, 2½″, 3″, 4″
Power Operated—size 3″ and 4″
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

THE ANSWER TO A PROBLEM

ALCO PIPE FOR CHICAGO

Cities using ALCO STEEL PIPE include the following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W Va
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y
New Brunswick, N.J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

The Water Department of Chicago and the Chicago Union Station were jointly and seriously concerned about the material to use in the 36" line to replace pipe running under the tracks of the station. The answer, illustrated above, is Alco Electric Welded Steel Pipe. No further need to worry about disastrous breaks.

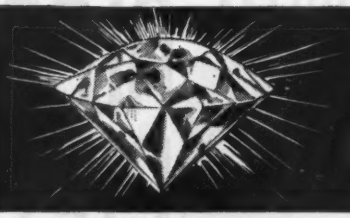
ALCO FEATURES

Greater Strength
Longer Life
Smoother Waterway
Longer Lengths
Fewer Field Joints
Low Initial Cost
Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS DIVISION
30 Church Street New York, N. Y.
CHICAGO WASHINGTON PITTSBURGH HOUSTON TULSA
Plants at Dunkirk, N. Y., and Montreal, Canada Cable Address: Alproducts

AMERICAN LOCOMOTIVE COMPANY



CARBON
In Its Highest Form

But Valueless for Water Purification

Although the diamond is carbon in its most valuable form, it is worthless compared to CLIFFCHAR ACTIVATED CARBON for water purification.

Leading municipalities place high value on CLIFFCHAR to remove objectionable taste and odors from water supply.

CLIFFCHAR "R"
Special Grade for Water Purification

Low phenol value, shown by standard phenol tests, gives high ability to remove phenolic and similar compounds.

Extreme fineness (99% passing a 325 mesh screen) gives maximum surface exposure and adsorptive capacity.

Controlled, uniform density assures sufficient suspension period to take full advantage of its high adsorptive ability, yet settle out in ordinary settling basins.

The technical and laboratory facilities of this company are available without obligation to those concerned with taste and odor problems in water purification. Your inquiry is invited.

Cliffs Dow

REG U S. PAT. OFF.

CLIFFS DOW CHEMICAL COMPANY, Marquette, Michigan

Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Sts., St. Louis; Field Bldg., Chicago

(*Continued from page 8*)

Interest in sanitary engineering is rapidly developing among our Latin-American neighbors. Attendants at the New Orleans convention will remember Molina, Merrick, Alarcon, and others from Mexico who were laying the groundwork for a section of the A.W.W.A. in their country.

From Cuba came Cosculluela and Garcia-Montes. The former had just given concrete evidence of his loyal interest in the A.W.W.A. by sending in the membership applications of eleven of his fellow Cuban citizens.

The Argentine Republic has just issued a 576-page documentary record of the travels and observations of a sanitary commission which toured this country in 1937. A perusal of the report indicates that the engineers who made the study managed to see the important recent developments in this country. It is also of interest to note that the JOURNAL of this association was the dominant reference source for these engineers.

Joseph M. Sanchis, formerly of the laboratory staff of the Los Angeles Water Department, is now developing a national laboratory for water supply problems in Venezuela. He reports a lively interest in modern sanitary engineering in that Republic.

(*Continued on page 12*)

BUY THE PIPE THAT GIVES YOU *All Five*

● Ideas about water supply lines have changed. Even among engineers who formerly recommended expensive, heavy-wall pipe, there is a definite trend to rolled iron and steel. And here's the reason:

Experience in hundreds of cities has proved that *rolled* iron and steel pipe offers five basic advantages for water supply lines. In Armco Spiral Welded pipe these five advantages combine to assure the *greatest service and safety per dollar of cost.*

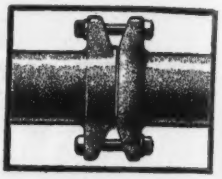
You'll be interested in the complete story. Address: The American Rolling Mill Company, Pipe Sales Division, 890 Curtis Street, Middletown, Ohio.

This long line of Armco Spiral Welded Pipe replaced a water supply line of another type which proved inadequate in size after 50 years of service.

ARMCO SPIRAL WELDED PIPE

UNIVERSAL CAST IRON PIPE

LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

THE CENTRAL FOUNDRY COMPANY

General Offices: 386 FOURTH AVENUE, NEW YORK

CHICAGO, ILL., 1105 W. 36th St. - OAKLAND, CALIF., 278 Fourth St.

OFFICES IN PRINCIPAL CITIES COAST TO COAST

(*Continued from page 10*)

Recollection of events of the past fifteen years and the visits of groups of young engineers in training under grants from the Rockefeller Foundation, leads to the opinion that this well organized use of American wealth is bearing good fruit in the sanitary advancements in Central and South America.

W. H. Weir, Assistant Sanitary Engineer of the Georgia State Board of Public Health, resigned as Secretary and Treasurer of the Southeastern Section of this association last April at the New Orleans meeting after a period of eight years service to his Section. Mr. Weir also served as director on the board of the American Water Works Association from 1935 to 1937.

The energy and enthusiasm which he put into his job more than doubled the membership of the Southeastern Section in a few years; one year won for the section the membership cup given for the greatest increase in membership among the various sections; and quickly established the section on a firm and progressive basis.

(*Continued on page 14*)

FIRST QUALITY METERS EXCLUSIVELY

SPECIFY *American* or *Niagara*

(BRONZE CASE) (IRON CASE)

Water Meters

WRITE FOR CATALOG

BUFFALO METER COMPANY

Established 1892 2914 Main St., Buffalo, N. Y.

YOU GET POSITIVE, REMOTE CONTROL *and economical* *with* CRANE CYLINDER OPERATED VALVES

FOR remote control of valves in water-works, sewage systems, and filtration plants, the logical choice is cylinder operation. Why? Because in these services, valves must respond unfailingly to central panel control. Cylinder mechanism is not dependent upon power supply which may be interrupted at an urgent moment. Too, since hydraulic power is most readily available at the point of valve application, the economical advantage of cylinder operation is of utmost importance to you.

The simple yet sturdy construction of Crane perfected cylinder mechanism is most desirable for your remote control installations. Easily installed, easily maintained at constant efficiency, it assures dependable flow-control.

But valve control is only half the story of valve performance. It's what's inside in every part that determines valve behavior in service. Your assurance of the right inside quality in Crane valves is in Crane's knowing how to build them for more than 80 years. It's Crane's skill in design, metallurgy, and engineering that gives Crane valves their unmatched stamina.

Reach for your Crane No. 52 Catalog now. It gives all the details on Crane cylinder operated double disc and wedge gate valves for water and sewage systems. They're made for all working pressures—in sizes up to 72 inches in all-iron or with brass trim. The Crane line includes every piping item you need—as well as valve operating mechanisms of every practical type.

4. Crane Double Disc Gate Valve with Brass Lined Cast Iron Operating Cylinder

CRANE

VALVES • FITTINGS • PIPE • PLUMBING • HEATING • PUMPS

CRANE CO., GENERAL OFFICES, 836 S. MICHIGAN AVE. CHICAGO, ILLINOIS

NATION-WIDE SERVICE THROUGH 134 BRANCHES AND MORE THAN 500 WHOLESALERS

IT'S WHAT'S INSIDE THAT COUNTS!

(*Continued from page 12*)

Mr. Weir, in his capacity as Assistant Sanitary Engineer of the Georgia State Board of Health, is in direct charge of water supply and sewage work. He has done an outstanding job in promoting better design and operation of water treatment and sewage disposal works. The Georgia Water Works and Sewage Operators' School, which he was instrumental in organizing, meets once each year.

The increased activity of his department made it impossible for him to continue his service with the Southeastern Section. The Trustees of the section reluctantly accepted his resignation. His interest in the affairs of the section, however, is as great as ever and such time as he can spare from his work will be available to it.

Some interest has been expressed in a short course or school for councilmen. It has been suggested, according to the League of Minnesota Municipalities, that a two-day school immediately after election or just before, or after the induction into office of new councils would be helpful in orienting newly elected councilmen in the duties and responsibilities of their offices.

(*Continued on page 15*)

The fire hydrant for maximum economy-safety-dependability

IF A Kennedy SAFETOP hydrant is struck by a smashing impact, there is no flooding, the water supply need not be shut off while awaiting or making repairs, and the hydrant can be returned to service by one man, within half an hour, without excavating, and at a total cost of less than $10.00 for new parts and labor.

In addition to these important benefits, the Kennedy SAFETOP Fire Hydrant responds promptly and effectively to service demands. Its large-diameter standpipe and smooth water passages keep pressure loss to a minimum, and its simple, sturdy, straight-line mechanism functions easily and positively.

Write for Complete Information

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY
SAFETOP
REG. U.S. PAT. OFF.
FIRE HYDRANT

(*Continued from page 14*)

George H. Fenkell, past-president of the A.W.W.A., General Manager and Chief Engineer of the Detroit Department of Water Supply from 1918 until his recent retirement, was honored by a testimonial dinner given July 14 by his former associates. Viewed in retrospect, there is hardly a member of this association who can look with equal pride to himself and with equal profit to his community upon a career of service equal to that of George Fenkell as Manager of the Detroit Water Department.

Beginning in the midst of wartime activities, his work carried through the period of accelerated growth of the world's automotive center. The early 20's were pressure days for many water departments, and—descending to faint levity for a moment—on quite a few occasions the pressure was not so good. Not the least of Detroit's problems was that of meeting the city's industrial growth with adequate water service. Not alone were there problems of over-all adequacy of supply, but those of locating additional structures so that distribution of the supply could be satisfactory.

The great Springwells filter plant and pumping station, located at a point reasonably close to the center of distribution demands rather than immediately adjacent to the Detroit River, was developed under Fenkell's direction. While the need for additional supply facilities in Detroit, as well as in many other industrial centers, has lessened, the long time validity of the ideas involved in the Detroit development cannot be successfully questioned. Mr. Fenkell continues as consultant to the Detroit Water Board. His interest in the A.W.W.A. continues as Director for the new Michigan Section.

The annual toll of typhoid fever, dysentery and other ills arising from vacationists drinking unsafe water has already started.

The 1938 season starts off with 40 cases of typhoid fever contracted by vacationists drinking well water at a roadside stand in Indiana. The well had been contaminated by a broken sewer only five feet from the well.

In various areas many cases of dysentery, intestinal "flu" and "summer complaint" are reported occurring from the use of impure water. Vacation joys may be followed by unpleasant ills if impure water is drunk by vacationists in their travels. The purity of water cannot be detected by taste or clarity. Germs are tasteless, odorless and invisible.

In several states it is now compulsory for wells and other water sources for tourists' use to be examined periodically and placards are posted to show that the supply is safe. Even in those states where such

(*Continued on page 16*)

(Continued from page 15)

examinations of water are not mandatory, any roadside stand or resort should, for its own protection, make sure that its water supply is free from contamination.

So great has been the progress of American cities in safeguarding their water supplies against contamination that many city dwellers do not realize that water as it occurs in nature may be impure.

The average city water is much safer than that found in brooks, springs and wells in the country, for the purity of city water is constantly supervised by trained and skilled men. That is evidenced by the fact that in the past 20 years deaths from typhoid fever in the principal American cities have dropped from more than 20 to less than one per 100,000 population annually. Water purification is chiefly responsible for that remarkable progress.

In recent years a number of outbreaks of water-borne ills have occurred in summer resorts, picnic grounds and recreational places. In a tourist camp in Canada in 1936 a spring polluted by leakage from a nearby septic tank caused 150 cases of diarrhea. In a resort in Missouri 2,000 persons were made ill by impure water during a recent summer

(Continued on page 18)

CLEAN YOUR WATER MAINS

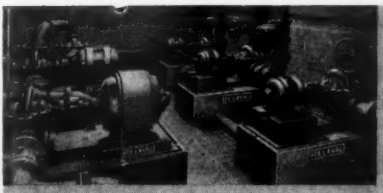
One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

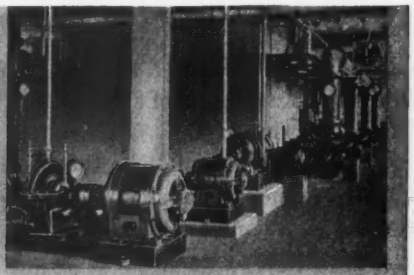
50 Church St., New York, N. Y.

BRANCHES

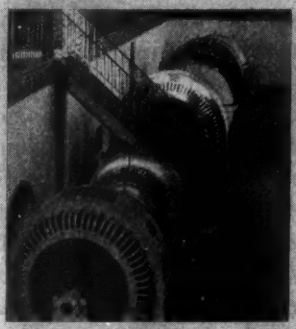
115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.



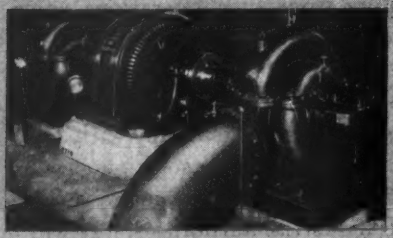
Water Works plant containing seven De Laval motor driven pumps; total capacity 7700 g.p.m.



Five motor driven pumps, ranging from 700 to 2700 g.p.m., which saved $11,053.39 in two years, as compared with older pumps.



Three pumping units which, including motors, tested over-all efficiencies of 86.14 to 88.0 per cent.



A 25 m.g.d. motor driven pumping unit which, after six years' service, tested 83.9 per cent wire to water efficiency.

De Laval Pumps with Motor Drive

save power and increase power factor

THE power limiting characteristic of the De Laval centrifugal pump protects the motor against overloading in the event of reduction of head pumped against.

The size of motor can be selected for highest efficiency under average load; an over-size motor is not necessary.

The low starting torque and the power-limiting characteristics of De Laval pumps both favor high power factor, and hence saving in line, transformer and generator losses and in generator capacity, and improve voltage regulation.

De Laval pumps are ideally suited to self-starting synchronous motors, which may be used to correct low power factor caused by other machines.

De Laval pumps show high efficiency initially and the De Laval LABYRINTH WEARING RINGS maintain this efficiency.

Ask for Leaflet E-1166.

DE LAVAL STEAM TURBINE CO., TRENTON, N. J.

4089

(*Continued from page 16*)

season. Of 21 reported outbreaks in summer recreational areas studied, there were 1,249 cases of typhoid and 2,884 cases of diarrhea and dysentery. Fifteen persons died.

Vacationists cannot be too fussy about their drinking water, and the annual summer toll of sickness from drinking impure water should be kept in mind as a constant warning.

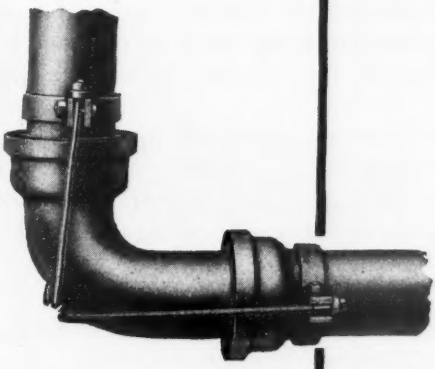
The American Water Works Association has a lively interest in a new research project at the Mellon Institute. In the iron and steel industry an outstanding problem is to prevent stream pollution by waste liquors from such operations as pickling, in which metal is commonly acid-treated. This industry, after endeavoring to solve this problem for many years at heavy expense, has recently founded, through the American Iron and Steel Institute, a fellowship at Mellon Institute of Industrial Research, in Pittsburgh, with the aim of acquiring novel ideas and attempting a definite solution just as soon as possible. This investigation will be carried on thoroughly until concluded to the satisfaction of health and industrial authorities. It will be the objective to treat or process the waste liquor of pickling plants so as to render it entirely safe for discharging into streams, recovering from it chemicals from which useful products can be made economically. Thousands of tons of iron and sulfuric acid are now wasted annually in various districts of this country by the lack of a suitable method of treatment, especially a procedure that can be employed on the large scale necessary in big mills; and through the fellowship at Mellon Institute a concerted effort will be made to take out the chemicals in solution in the liquor by a satisfactory procedure and to discover uses for them.

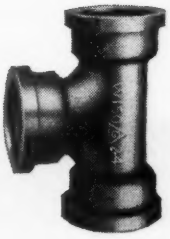
Willard W. Hodge, professor of chemical engineering and head of the Department of Chemical Engineering at West Virginia University, and also director of the Engineering Experiment Station of that institution, has been granted a year's leave of absence to head this investigational work at Mellon Institute. He is well known professionally as a specialist on the disposal of waste effluents and control of stream pollution.

The water supply field will watch this research program with interest and welcome the constructive developments which doubtless will result from it.

Mike Hoffman of Cincinnati reports that "The Bureau of Meter Repairs of the Commercial Division of the Cincinnati Water Works, being up to date on all meter repairs, has inaugurated a program of checking

(*Continued on page 20*)





Easier to use

The compact design of Grinnell Socket Fittings reduces the size and weight of fittings . . . lessens friction losses.

Savings in installation time and lower materials cost are direct results obtained through this improved design. Connections—even in the most limited spaces are easily accomplished with Grinnell Socket Fittings. Grinnell Company, Inc., Executive Offices, Providence, R. I., Branch offices in principal cities.

SOCKET FITTINGS BY

GRINNELL

...WHENEVER PIPING IS INVOLVED...

(*Continued from page 18*)

and testing the older meters in service. That this procedure is worth while has been proved by the fact that of the first fifty meters tested it was found that forty-seven were in need of replacement, as they had been in service for more than thirty years and had shown a considerable under-registration.

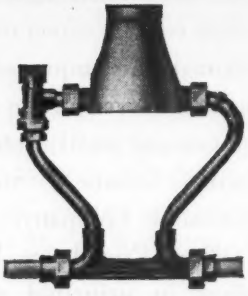
"In the language of the water works executive, this means that there had been considerable loss of revenue for an indefinite period of time. This experience shows clearly how necessary it is to keep up an aggressive meter maintenance program if the potential benefits of measured sales of water are to be attained."

Extraordinary precautions are being taken in New York to eliminate all possible sources of danger of contamination of drinking water through faulty plumbing in hotels, restaurants and buildings serving the public.

The tragic outbreak of amoebic dysentery in two Chicago hotels in 1933 brought forcibly to the attention of the public the dangers that lurk in cross-connections and faulty plumbing, and New York is taking steps

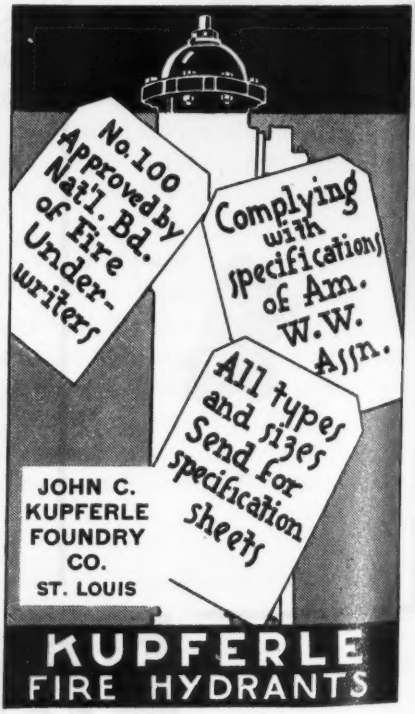
(*Continued on page 22*)

The Coppersetter
. A COMPLETE METER MOUNTING



The COPPERSETTER is a simple, convenient and durable fitting for installing water meters in horizontal service lines. It is all brass and copper, made in several heights and can be provided with an inverted ground-key angle valve at the meter inlet. Write for more information about the COPPERSETTER.

The Ford Meter Box Co.
WABASH, INDIANA


No. 100 Approved by Nat'l. Bd. of Fire Under-writers
Complying with specifications of Am. W.W. Assn.
All types and sizes Send for specification sheets
JOHN C. KUPFERLE FOUNDRY CO.
ST. LOUIS

KUPFERLE
FIRE HYDRANTS

The name **HERSEY** stamped on a water meter satisfies Water Works Officials that they are getting the best meter that money can buy—one whose accuracy and performance will continue year after year without expensive upkeep.

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK—PORTLAND, ORE.—PHILADELPHIA—ATLANTA—DALLAS—CHICAGO
SAN FRANCISCO—LOS ANGELES

(*Continued from page 20*)

to eliminate all hazards to the public's health that may arise from defective plumbing before the 1939 fair.

In a sanitary survey of 1,200 buildings in New York City recently completed, the health department found 511 plumbing cross-connections, some of them of a serious nature. These conditions are now being corrected in anticipation of the heavy demands to be placed upon such facilities when millions flock to New York next year.

Public health officials in both large and small cities should make sanitary surveys of the plumbing facilities in hotels and large buildings. Municipal water plants take great care to safeguard the purity of the water supply, but it should be protected further when it enters the customer's premises.

Such sanitary surveys to safeguard the public's health may well be undertaken as WPA projects, for possible danger to the water supply from defective plumbing is to be found in hundreds of cities.

The immediate utilization of much research is often impeded by the researcher's inability to express himself plainly.

(*Continued on page 26*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2″ to 84″

Flanged Pipe ***Flexible Joint Pipe***

Bell and Spigot Pipe

Special Castings ***Short Body B. & S. Specials***

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

MORRIS KNOWLES, INC.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.
Pittsburgh, Pa.

ALEXANDER POTTER
Consulting Engineer
Specialties: Water Supply and Sewerage
50 Church St. New York City
Telephone 5501 Cortlandt

METCALF & EDDY
Engineers
Charles W. Sherman — John P. Wentworth
Almon L. Fales — Harrison P. Eddy, Jr.
Frank A. Marston — Arthur L. Shaw
E. Sherman Chase
Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories — Valuations
Boston, Mass. Statler Building — **Harrisburg, Pa. Telegraph Building**

CLYDE POTTS
M. Am. Soc. C. E.
Consulting Sanitary Engineer
30 Church Street - - New York
Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

REEVES NEWSOM
Engineer - Consultant
Supply, Purification and Distribution of Water
Operation — Design — Construction
Valuation — Rates — Negotiations
Investigations — Taxes — Accounting
500 Fifth Avenue New York City

SCOFIELD ENGINEERING CO.
Consulting Engineers
Water, Gas, Electric Plants and Distribution Systems
Appraisals, Valuations and Reports
Design—Supervision—Operation
Philadelphia, Penna.

PEASE LABORATORIES, INC.
39 West 38th Street, New York
Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.
Chemists Field Sanitary Surveys
Bacteriologists Consultants

WESTON & SAMPSON
Robert Spurr Weston — G. A. Sampson
Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.
14 Beacon St. Boston, Mass.

MALCOLM PIRNIE
Engineer
Water Supply, Treatment, Sewerage,
Reports, Plans, Estimates,
Supervision and Operation
Valuation and Rates.
25 W. 43rd St., New York, N. Y.

WHITMAN, REQUARDT AND SMITH, *Engineers*
Ezra B. Whitman — Norman D. Kenney
Gustav J. Requardt — Robert T. Regester
Benjamin L. Smith — Theodore W. Hacker
WATER WORKS - SEWERAGE - UTILITIES
Baltimore, Md. Albany, N. Y.

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings
50 Church St. New York City

Help Build up Your Association by Bringing in a New Member
SEND FOR APPLICATION BLANK
AMERICAN WATER WORKS ASSOCIATION
22 East 40th St. NEW YORK CITY

(*Continued from page 22*)

Frank T. Sheets, in an address before the American Concrete Institute early this year, made certain comments concerning the gap between research and practice that are worthy of repetition here. This time-lag, he states, is due to inability of many research men to translate their work into understandable language and further to the lack of the ability to "sell" the ideas.

He classes the research men into these groups:

1. Inhabitants of the technical stratosphere—men who think so deeply in their particular field that rather complicated statements seem simple to them, and who are not conscious of being profound—"who could not if they would," talk the language of the practitioner.

2. Cloud riders—not quite so abstract or profound in their thinking and utterances as the stratospherists, but still difficult for the practitioner to follow.

3. Technical adventurers, engaging in research mainly for the fun of it, largely indifferent to responsibility of interpreting results and completing investigations, and constantly looking for new fields to conquer.

(*Continued on page 28*)

PLAY SAFE!

Specify LUDLOW HYDRANTS

Ludlow Hydrants are always ready for action—easy to maintain—easily repaired when broken off. They drain from the bottom to eliminate freezing; break only above ground; offer no obstruction to flow of water; prevent water hammer. And they are attractively modern. Send for free catalog.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

It makes NO difference to

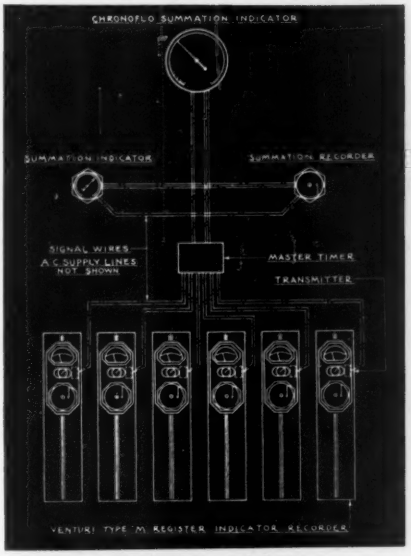
% PROPORTIONEERS %

"Perchloron"
"HTH"
"Columbia"
"Wil-Chlor"
"Maxochlor"
"Purex"
"Chlorofectant"
"Chlorox"
"Isco"
"Kohnstamm"
"Clor-O-Mor"

Accurately fed by Chlor-O-Feeders, these chemicals have all been proved practical in chlorinating medium and small water and sewage plants; and even to sterilize big plants in emergencies.

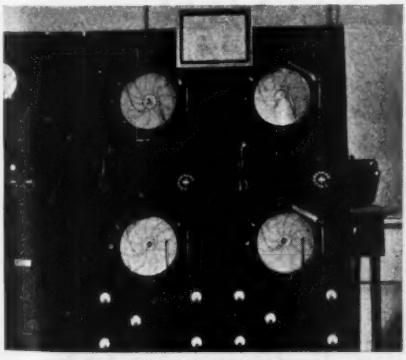
% PROPORTIONEERS, Inc. %
18 Codding St., Providence, R.I.

CHRONOFLO METER APPLICATIONS



SUMMATION

Totalizing flow through a group of individual meters located any distance apart.



REMOTE CONTROL

Records from distant stations make possible automatic remote control of pressure, level, and flow.

"CHRONOFLO"—Registered U. S. Patent Office

Ask for NEW Bulletin, 298

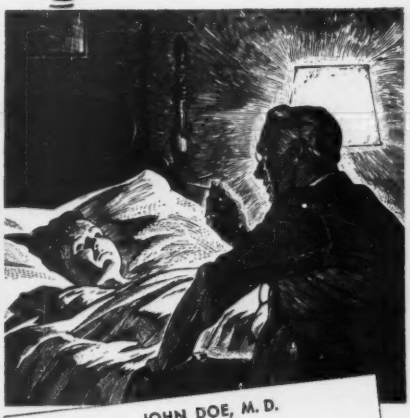
BUILDERS IRON FOUNDRY

"Builders of Venturi Since 1891"

9 CODDING ST., PROVIDENCE, R. I.

"C'MON IN, DAN, THE WATER'S SWELL"

(BUT IT WASN'T SO CLEAN)



JOHN DOE, M. D.
Patients Record

Name Harvey, Edward Age 11
416 Pine St.

Examination Temp 104 Pulse slow, Blood count shows Leukopenia*. Mother states child has had only artificial milk. Has been swimming daily in Johnson's Creek where town Sanitation Committee recently discovered typhoid bacilli—

* Reduced white blood corpuscles.

Johnson's Creek might be any creek or stream throughout the country—Edward Harvey, any American boy . . .

Pollution of streams by sewage (and some insufficiently purified effluent from plants) is fast becoming a major problem. *Be doubly certain!* Purify all effluent from disposal plants with Solvay Liquid Chlorine!

Immediate shipments of Solvay Liquid Chlorine are available in cylinders or tank cars for swimming pools, sewage and water purification plants.

SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 RECTOR STREET NEW YORK, N. Y.

SOLVAY
LIQUID CHLORINE

(*Continued from page 26*)

4. The technical snobs—thank heaven they are few—who like to talk a ten cent idea in ten dollar language, thus impressing the uninformed with their profound minds.

5. The self-advertisers, thinking of research primarily as a ladder to personal success.

6. The conscientious thinkers.

7. The unselfish servers of fellow engineers.

8. The rare species, who simultaneously contribute unselfishly, think deeply, conclude soundly, talk simply.

The men who are called upon to put research into practice—the "practitioners," Sheets calls them, may be classed in the following categories:

1. Busy executives, scientifically inclined, open-minded, but too busy to delve into research details.

2. Busy executives, non-scientific in instinct, impatient of detail and given to direct action.

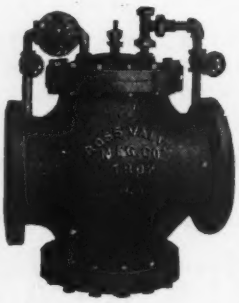
3. The closed-minded individuals, self-sufficient in their own knowledge, who are inclined to pooh-pooh any proposition, with which they are not acquainted, as abstract theory.

(*Continued on page 30*)

THE STANDARD
for more than
50 YEARS

WATER WORKS SPECIALTIES

•



Automatic Pressure Control Valves

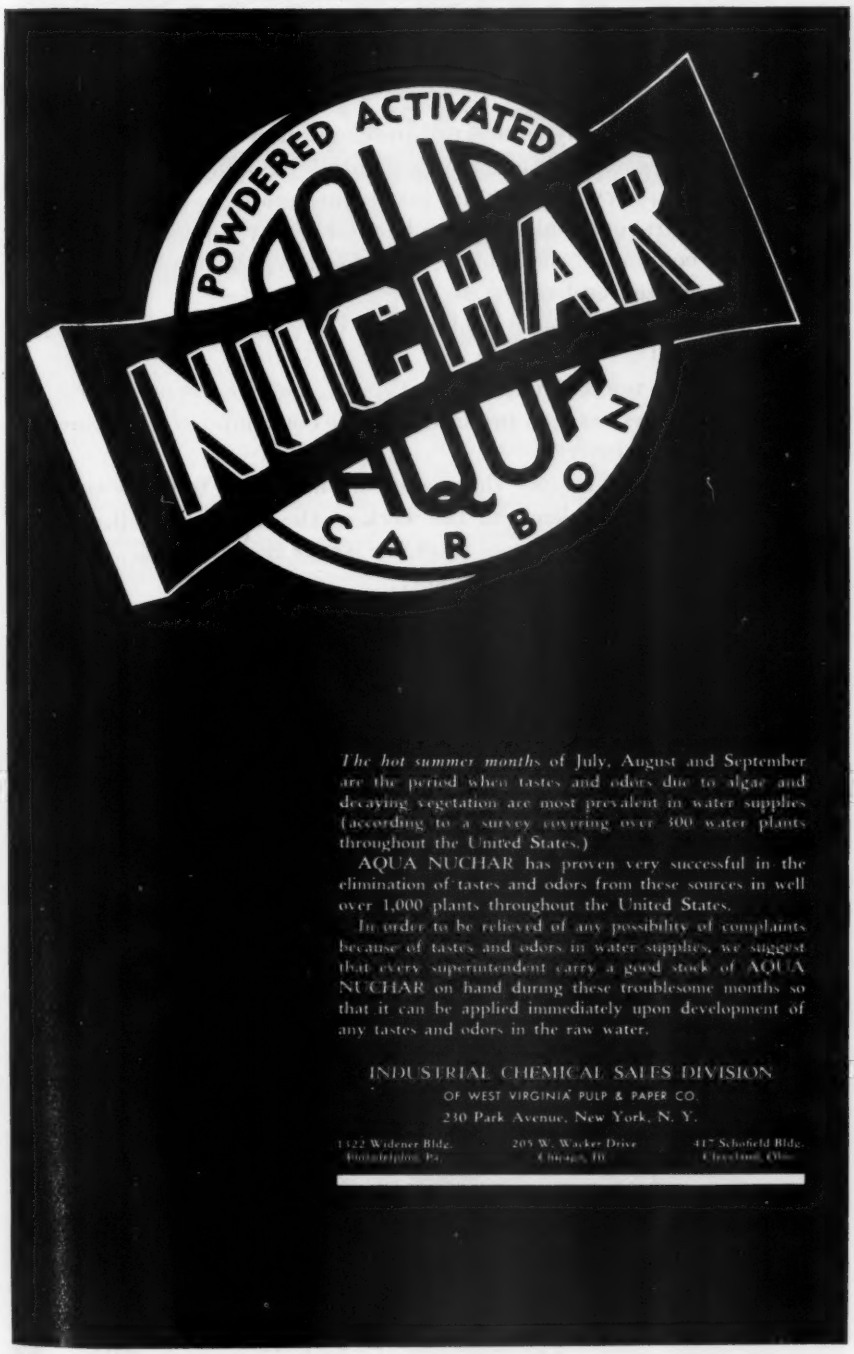
Pressure Reducing-Altitude

Surge-Relief and Combination Valves

Portable Fire Hydrants

Hydraulic Booster Pumps

ROSS VALVE MFG. CO., INC. TROY, N. Y.



The hot summer months of July, August and September are the period when tastes and odors due to algae and decaying vegetation are most prevalent in water supplies (according to a survey covering over 300 water plants throughout the United States.)

AQUA NUCHAR has proven very successful in the elimination of tastes and odors from these sources in well over 1,000 plants throughout the United States.

In order to be relieved of any possibility of complaints because of tastes and odors in water supplies, we suggest that every superintendent carry a good stock of AQUA NUCHAR on hand during these troublesome months so that it can be applied immediately upon development of any tastes and odors in the raw water.

INDUSTRIAL CHEMICAL SALES DIVISION
OF WEST VIRGINIA PULP & PAPER CO.
230 Park Avenue, New York, N. Y.

1422 Widener Bldg. Philadelphia, Pa. | 205 W. Wacker Drive Chicago, Ill. | 417 Schofield Bldg. Cleveland, Ohio

(*Continued from page 28*)

4. The so-called practical engineers, scoffing at any problem involving more than arithmetic and simple equations.
5. The know-it-alls.
6. The do-it-the-way-we-learned-in-school crowd.
7. The copy cat, tradition-loving, mentally lazy flock.
8. The very, very few who are just plain dumb.
9. The smart, open-minded searchers for better things.

To this composite and widely varying crew, the fruits of research must be interpreted and sold.

With two such groups to deal with, it is not to be wondered at that the time-lag exists.

Impediment number one is the typical research report. Research reports are too often written primarily for the consumption of researchers, rather than practitioners.

They frequently require the reader of the report to know as much about the research problem and the work as the writer himself, in order to gain a clear understanding of what the writer really means. They are not directed at the ultimate consumer.

(*Continued on page 32*)

THE STERLING DIESEL ENGINE

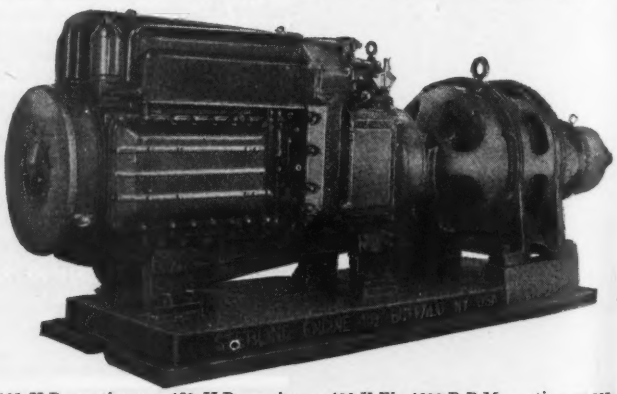
achieves natural turbulence without using pre-combustion chambers or cylinder heads or valves

Best atomization of fuel is secured with high efficiency. Ample air intake and exhaust ports scavenge the cylinder completely. Pistons act also as valves, eliminating many parts.

STERLING HIGH DUTY

Sterling

INTERNAL COMBUSTION ENGINES



135 H.P. continuous, 150 H.P. maximum, 100 K.W., 1200 R.P.M. continuous service Sterling Diesel Generator Set. (*Michell Patents*)

If you contemplate a diesel installation, investigate the possibilities of direct connecting the Sterling engines to pump or generator. Save tremendously in first cost and in fixed charges.

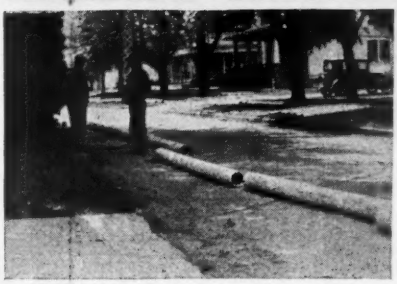
GAS — GASOLINE — DIESEL — ENGINES

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

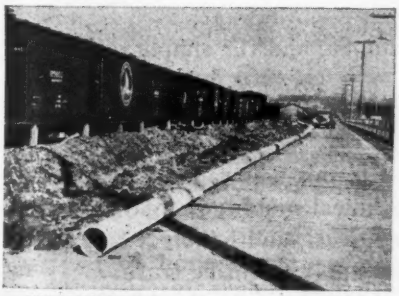
STERLING ENGINE COMPANY
Dept. C-3

Branch Office
900 Chrysler Bldg
New York, N. Y.

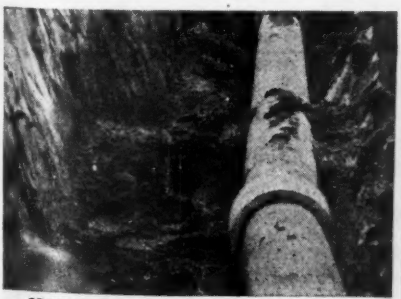
MORE MILES of TRANSITE PIPE...



OHIO: Hundreds of American municipalities have made sizable savings in water-distribution costs by using J-M Transite Pipe. Shown above is one of many complete Transite systems installed in 1937.



WASHINGTON: Simplex Couplings stay tight even when subjected to vibration from near-by railroad trains. And Transite's immunity to electrolysis, when laid near electric lines, is added assurance of virtually trouble-free life.



MAINE: Because Transite Pipe is non-metallic, tuberculation is a physical impossibility. A permanently smooth interior keeps pumping costs low, delivery capacity high, indefinitely.

and every foot CUTS COSTS

TROUBLEPROOF pipe means real economy on water-transportation systems. And on hundreds of installations all over the country, J-M Transite Pressure Pipe is bringing operating costs to new lows.

Transite Pipe, made of asbestos fiber and cement, is non-metallic and highly resistant to corrosive soils and ground waters. Tuberculation is impossible. High delivery capacity continues indefinitely . . . keeping pumping costs down.

At installation, too, Transite Pipe provides new economy. Unskilled workmen can lay it rapidly. Simplex Couplings help speed up assembly . . . eliminate caulking operations. Trenches can be held to minimum widths. The result: substantial savings in time, labor and materials.

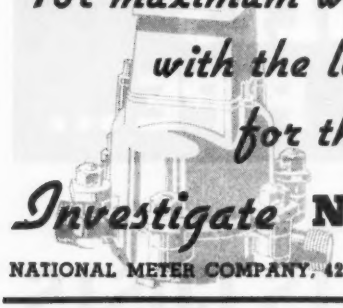
Yet Transite Pipe costs no more than ordinary pipe. Check complete details; you'll see other ways you can benefit. Write for the new Transite Pressure Pipe brochure. Johns-Manville, 22 East 40th St., New York, N. Y.

JM Johns-Manville

TRANSITE PRESSURE PIPE

An Asbestos Product

For maximum water revenue
with the lowest maintenance
for the longest period of time



Investigate **NATIONAL** *Meters*

NATIONAL METER COMPANY, 4207 First Ave., Brooklyn, N. Y.

(*Continued from page 30*)

In our civic experience whenever we encounter a distressing condition, the first cry is for legislative reform. And so, as I contemplate this problem, I am tempted to say "There ought to be a law" providing that:

1. All researchers must try to determine what the problem is before they start to solve it.
2. All researchers must analyze results and prepare an understandable report on completed projects before new ones can be started.
3. All the profound shall try to be simple, and the simple to be profound.
4. A practitioner shall be outlawed if he doesn't keep up with research and apply it.
5. The researcher shall be ostracized by his fellows if he forgets the need of the practitioner or indulges in technical snobbery.
6. Interpreters shall be born, trained, used, and honored.
7. All must search for, recognize and apply scientific truth.
8. All researchers must recognize that the intelligence quotient rating of practitioners as a body is probably reasonably near that of the researchers as a body.

(*Continued on page 36*)

EVERSON STERILIZING APPARATUS

Feeds, Measures and Mixes Chlorine Gas

A complete line of new and better apparatus for controlling, feeding and mixing chlorine gas, ammonia, etc. into solutions—for sterilizing drinking water, sewage or swimming pools.

Write for Bulletin and Catalog of Swimming pool equipment and Supplies.

EVERSON MANUFACTURING CO.
"The Swimming Pool People"
221 W. Huron St., Chicago, U. S. A.

JOURNAL

If you have any old copies of the Journal you would like to dispose of, see page 4.

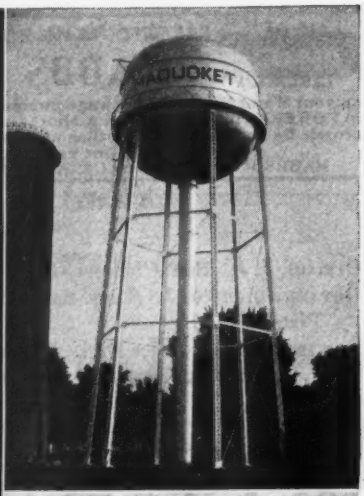
AMERICAN WATER WORKS ASSOCIATION

P·DM

Means...

PROVED
DEPENDABLE
MATERIAL

Properly Designed and Manufactured



... This has been true for over forty years. ● In the building of Elevated Steel Tanks — as in all its manufacturing activities, Pittsburgh-Des Moines achieves the ideal of *Quality . . . at Lowest Cost.* Quality in intelligent design . . . quality in materials, full weight and honestly fabricated . . . quality in workmanship and erection — *at lowest cost to you* by means of modern efficiency in manufacture and the plain "know-how" of experience. Are Elevated Steel Tanks a present concern of yours? P·DM maintains a complete engineering advisory service at the disposal of any interested authority, without obligation. For a consultation, write to our nearest office — and ask for your copy of P·DM's 20-page "Modern Water Storage" Bulletin!

PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, PA. 3424 NEVILLE ISLAND
DES MOINES, IA. 925 TUTTLE STREET

NEW YORK . . . . . ROOM 921-99, 270 BROADWAY
CHICAGO . . . 1228 FIRST NATIONAL BANK BUILDING
DALLAS . . . . . 1229 PRAETORIAN BUILDING
SAN FRANCISCO . . . . . 631 RIALTO BUILDING

Trade Mark MABBS Reg. U. S. Pat. Off.

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

(*Continued from page vi*)

DILLON, J. J. San. Chemist, R. I. Dept. of Public Health, Providence, R. I.

DOTTERWEICH, A. J. Dist. Sales Engr., Permutit Co., 615 Dollar Sav. & Tr. Bldg., Pittsburgh, Pa.

EDWARDS, D. W. Vice Pres., Layne Louisiana, Inc., Lake Charles, La.

ETCHISON, E. C. Supt. of Filtration, West Point Mfg. Co., Fairfax Mill Div., Fairfax, Ala.

FABRIN, A. O. Chief Engr., Layne & Bowler Co., Memphis, Tenn.

FITZGERALD, R. W. Chief Chemist, Div. of Water, Norfolk, Va.

HELWICK, CHAS. H. Asst. Supt. of Dist., City Water Dept., Jacksonville, Fla.

HOLLOWELL, C. Q. Supt. of Light & Water Dept., Leland, Miss.

HUTCHISON, F. Y. Chief Engr., Houston Pipe Line Co., Houston, Tex.

JENSEN, O. F. Mgr. of Layne Texas Co., 6931 Ranisburg Bldg., Houston, Tex.

KING, R. M. Chief Engr., Layne Arkansas Co., Stuttgart, Ark.

OLIVER, R. L. Service Engr., Dearborn Chemical Co., 2029 Huntington Lane, Fort Worth, Tex.

PHILLIPS, M. H. Supt., Paragould Water Works, Paragould, Ark.

REED, JOHN K. Div. Supt., Div. Maint. & Reading, Dept. of Municipal Water & Light, Coldbrook & Monroe Sts., Grand Rapids, Mich.

SEAY, J. I. Pres., Layne Central Co., Memphis, Tenn.

SALTER, FITZGERALD. Supt. of Water, Montgomery, Ala.

SMITH, HAROLD T. Water Supply Contractor, Apt. 3 F 3, Torreon, Coah, Mexico.

SMITH, NORMAN F. Water Supply Contractor, Box 406, Miami, Fla.

STOTT, ROY. Mgr., Light & Water Dept., Greenwood, Miss.

TAPPEN, RAY. Supt., Jericho Water Dist., Box 434, Glen Head, N. Y.

TILLMAN, M. W. Supt. Water & Light Dept., West Point, Miss.

TURNER, JAMES V. Supt. Water Works, Providence, R. I.

VIENO, R. R. Supt. Dist. Water Dept., City Hall, Beaumont, Texas.

WELDON, WM. B. Asst. Engr., 404 City Hall, Chicago, Ill.

WICKHAM, R. B. Supt. of Power, Langdale, Ala.

ZAPATA, F. A. Rep., U. S. Pipe & Fdry. Co., Apartado 99, Mexico, D. F., Mexico.

Reinstatements (Active)

BLAKEMAN, H. W. Supt., Water Dept., Rayville, La.

HAWKEN, FRANK S. Sr. Chem. Engr., 3954 Greer Ave., St. Louis, Mo.

SPARKS, O. L. Supt. Water & Light, Tupelo, Miss.

TYLER, O. Z. Supt. Houghling Water Dept., Utilities Bldg., Jacksonville, Fla.

Resignations, June 1 to 30, 1938

BOARDMAN, JOHN. Foreman, Water Dept., Compton, Calif.

CULLMAN, CITY OF. J. A. Dunlap, Mayor, City Light & Water Plant, Cullman, Ala. (Corp. M.)

GEHRING, H. F. Dist. Engr., Johns-Manville Sales Corp., 743 Henry Bldg., Seattle, Wash.

(*Continued on page 36*)

Good workmen + good tools =

GOOD Water Meters

•

Skilled workmen + better tools =

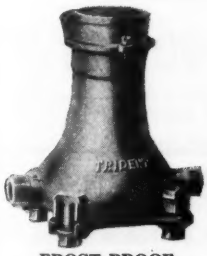
BETTER Water Meters

•

Skilled workmen + PRECISION equipment =

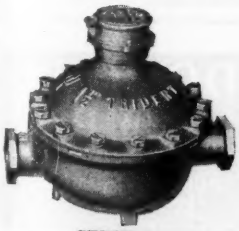
TRIDENT WATER METERS

Better water meters made better sums up the results of what Neptune has accomplished. No design has been changed. Using special modern precision equipment, finer gauges and improved production methods, we are today making meters that set new standards for sustained accuracy, sensitivity, interchangeability, long life, low maintenance costs. Neptune Meter Company, 50 West 50th Street (Rockefeller Center), New York City. Neptune Meters, Ltd., 345 Sorauren Avenue, Toronto, Canada.



FROST PROOF
With Breakable Bottom
Sizes ⅝″ to 1″

TRIDENT



STYLE 3
For medium class service
Sizes 1½″ to 2″ Screw End
1½″ to 6″ Flange End

CREST
Velocity or inferential type with turbine or propeller for high rates of flow
Sizes 1½″ and 2″ Screw End
1½″ to 16″ Flange End

COMPOUND
For both large and small flows
Sizes 1½″ and 2″ Screw End
1½″ to 10″ Flange End

(*Continued from page 32*)

Lieut.-Col. C. H. H. Harold, Director of Water Examination of the Metropolitan Water Board of London, died on July 18 after a brief illness. He succeeded, in 1934, Sir Alexander Houston who had been for many years in charge of the Metropolitan laboratories.

Col. Harold had a fine record in the British army sanitary staff, both in India and in England. Many members of this Association in the United States will remember him upon the occasion of his tour in 1936, when he was planning the new laboratories for London's water examination work. He was then found to be a fully progressive, amply informed, and thoroughly resourceful water supply sanitarian from whom many more years of fruitful activity were to be expected.

(*Continued from page 34*)

INGRAM, FRED R. 826 Shattuck Ave., Berkeley, Calif.
LEWISTOWN-REEDSVILLE WATER CO., Box 68, Lewiston, Pa. (Corp. M.)
LOH, P. Y. Graduate Student, Purdue Univ., P. O. Box 521, West Lafayette, Ind.
SHERMAN, LEROY K. Cons. Engr., 1504 Monadnock Block, 53 W. Jackson Blvd., Chicago, Ill.
THON, GEO. L. Supt. of Water & Light, Aurora, Ill.
VAN HECKE, CHAS. E. Supt., City Water Dept., Stevens Point, Wis.
WHITE, CHARLES F. Engr., 195 Wellesley St., Toronto, Ont. Canada.

Death, June 1 to 30, 1938

FARMER, JOHN B. Supt. of Water Works, 515 S. Maney's Ave., Murfreesboro, Tenn.

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.
Lawrenceburg — Indiana

WELL SCREENS

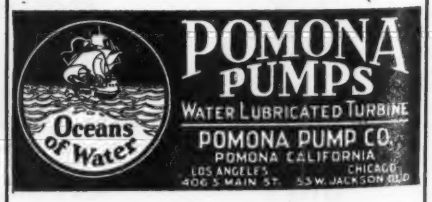
To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.

2304 Long Avenue,
St. Paul, Minn.

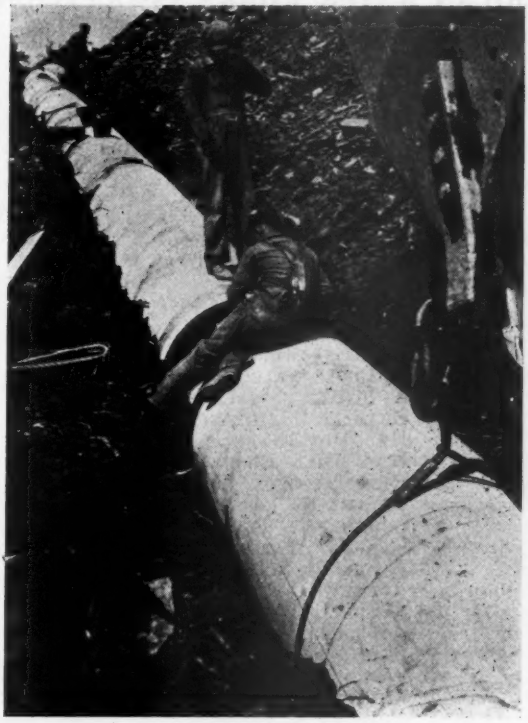
SAVE 80% ON YOUR TRENCHING COSTS WITH A
GIANT PIPE PUSHER

10 DIFFERENT SIZES
TO FILL EVERY NEED
WRITE FOR CATALOG
Dept. P-3
GIANT MFG. CO.
Council Bluffs, Iowa



Sept.

The LOCK JOINT "Book of Experience"



Installing Pipe in the City of Little Rock, Arkansas

10,000 Flawless Expansion Joints

ON the 32 mile pipe line of 39" diameter Lock Joint Reinforced Concrete Pressure Pipe recently completed for the City of Little Rock, Arkansas, *not one* of the more than 10,000 joints showed any signs of leakage during the tests for final acceptance of the line.

In fact, the results of these tests showed the measured leakage to be less than ten percent of that permitted under the specifications, proving again the superior watertightness of Lock Joint Pipe Lines.

LOCK JOINT PIPE CO., Ampere, New Jersey
PRESSURE : SUBAQUEOUS : SEWER : CULVERT

LOCK JOINT Reinforced CONCRETE PRESSURE PIPE

AMERICAN WATER WORKS ASSOCIATION

Headquarters Office

22 East 40th St., New York

Officers

President	REEVES NEWSOM Engineer-Consultant, 500 Fifth Avenue New York, N. Y
Treasurer	WILLIAM W. BRUSH
Secretary	HARRY E. JORDAN
Assistant Secretary	P. S. WILSON

Board of Directors

Representing the Local Sections

California Section	NELSON A. ECKART, San Francisco, Cal.	to–1939
Canadian Section	ALBERT E. BERRY, Toronto, Ont.	–1940
Central States Section	H. LLOYD NELSON, Philadelphia, Penna.	–1941
Illorida Section	A. P. BLACK, Gainesville, Fla.	–1939
Four States Section	CHARLES H. BECKER, Philadelphia, Pa.	–1939
Illinois Section	HAROLD E. BABBITT, Urbana, Ill.	–1939
Indiana Section	H. A. DILL, Richmond, Ind.	–1940
Kentucky-Tennessee Sect.	E. E. JACOBSON, Lexington, Ky.	–1941
Michigan Section	GEORGE H. FENKELL, Detroit, Mich.	–1941
Minnesota Section	LEONARD N. THOMPSON, St. Paul, Minn.	–1939
Missouri Valley Section	EARLE L. WATERMAN, Iowa City, Iowa	–1941
Montana Section	JOSEPH M. SCHMIT, Lewistown, Mont.	–1939
New England Section	ROGER W. ESTY, Danvers, Mass.	–1941
New Jersey Section	SAMUEL F. NEWKIRK, Elizabeth, N. J.	–1941
New York Section	WILLIAM A. MCCAFFREY, Oswego, N. Y.	–1941
North Carolina Section	PAUL W. FRISK, Enka, N. C.	–1940
Ohio Section	WALLACE W. MOREHOUSE, Dayton, Ohio	–1939
Pacific Northwest Sect.	MILTON H. MCGUIRE, McMinnville, Oregon	–1941
Rocky Mountain Section	CHESTER A. TRUMAN, Colo. Sprgs., Colo.	–1940
Southeastern Section	J. K. MARQUIS, Spartanburg, S. C.	–1940
Southwest Section	JOHN B. WINDER, Dallas, Texas.	–1939
Virginia Section	MARSDEN C. SMITH, Richmond, Va.	–1940
Wisconsin Section	ARTHUR H. MILLER, Sheboygan, Wis.	–1940

Representing the Water Works Manufacturers Association

Manufacturer	DENIS F. O'BRIEN, East Orange, N. J.	–1939
Manufacturer	WILLARD T. CHEVALIER, New York, N. Y.	–1940
Manufacturer	CLINTON INGLEE, New York, N. Y.	–1941

Ex-Officio Members of the Board

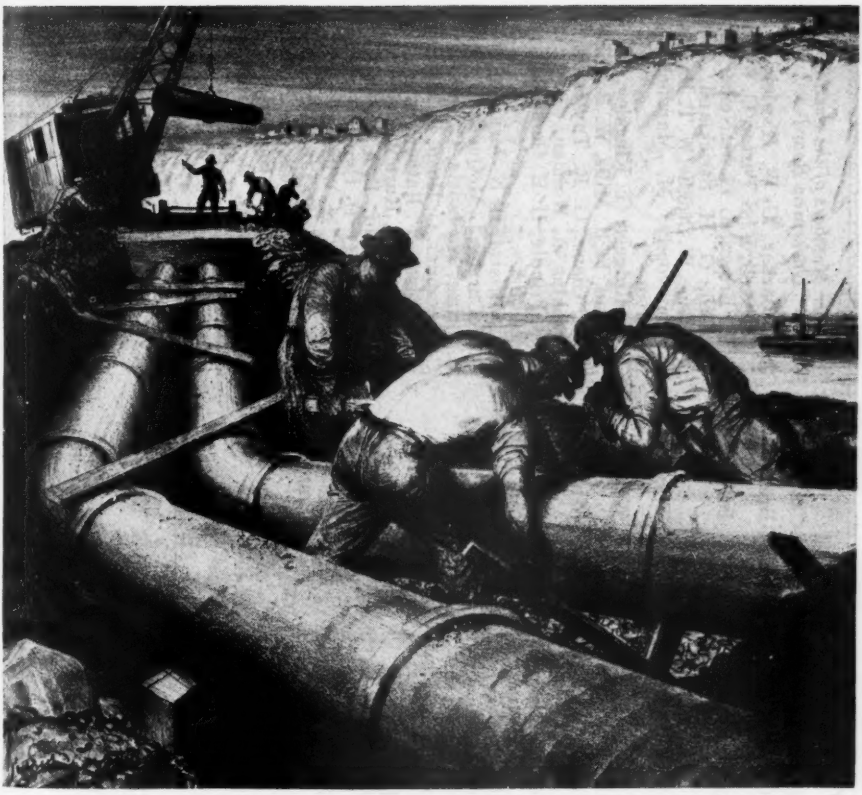
President	REEVES NEWSOM, New York, N. Y.	–1940
Past President	EUGENE F. DUGGER, Newport News, Va.	–1939
Treasurer	WILLIAM W. BRUSH, New York, N. Y.	–1939
Ch.W.W. Practice Comm.	MALCOLM PIRNIE, New York, N. Y.	–1939
Ch. Publication Comm.	LINN H. ENSLOW, New York, N. Y.	–1939

Officers of the Divisions

Finance and Accounting Division.—Chairman, M. F. HOFFMAN; Vice-Chairman, DALE L. MAFFITT; Secretary-Treasurer, WILLIAM J. SCHWARTZ; Directors, JACOB SCHWARTZ, HAL F. SMITH.

Plant Management and Operation Division.—Chairman, THOMAS L. AMISS; Vice-Chairman, A. P. KURANZ; Secretary-Treasurer, D. D. GROSS; Directors, SAMUEL F. NEWKIRK, L. S. VANCE.

Water Purification Division.—Chairman, CHARLES GILMAN HYDE; Vice-Chairman, CHARLES H. SPAULDING; Secretary-Treasurer, CHARLES R. COX; Past Chairman, WILLIAM M. WALLACE; Additional members of Executive Committee, M. C. SMITH, PAUL WEIR.



Lithographed on stone by James E. Allen for U. S. Pipe & Foundry Co. Copyright 1937, U. S. Pipe & Foundry Co.

ALL along the line, from the blast furnace through the cupola to the fore-hearth for a battery of Super-de Lavaud centrifugal casting machines, improvements in metallurgy have gone hand-in-hand with advanced techniques in pipe production. Without benefit of these improvements, cast iron pipe laid generations ago has set amazing records of economy and long life. Yet, today's cast iron pipe is unquestionably better, giving added assurance of long, uninterrupted service under costly modern pavements and congested traffic.

U.S. cast iron PIPE

U. S. PIPE & FOUNDRY CO., BURLINGTON, NEW JERSEY

Foundries and Sales Offices throughout the U. S.

Officers of the Sections

Section	Chairman	Vice-Chairman	Secretary-Treasurer	Past-Chairman	Other Members of the Section Governing Board[1]
California	J. E. Phillips	H. Reinhardt	C. M. Hoskinson	R. F. Brown	J. R. Barker, G. W. Hawley, J. S. Longwell, F. S. Porter, C. Wilson.
Canadian	A. B. Manson	—	A. E. Berry	E. V. Buchanan	C. E. Brown, L. G. McNeice, R. J. Smith, G. H. Strickland, F. G. Browne, W. Storrie, W. T. Randall.
Central States	C. H. Young	E. A. Johnson	E. P. Johnson	E. C. Trax	J. Dunwoody, M. Mansfield, A. Martin
Florida	T. M.Lowe	G. F. Catlett	J. R. Hoy	D. S. Wallace	R. G. Ridgely, G. Kingsley, K. R. Chinn, F. R. Mills, W. B. Gibson
Four States	H. M. Freeburn	C. J. Lauter	C. A. Hechmer	E. B. Whitman	I. M. Glace, G. R. Taylor, E. S. Hopkins, A. Wolman.
Illinois	W. D. Gerber	F. G. Gordon	C. W. Klassen	F. C. Amsbary	G. B. Prindle, H. H. Gerstein.
Indiana	P. C. Laux	M. H. Schwartz	J. A. Bruhn	J. L. Ford	C. L. Link.
Kentucky-Tenn.	C. M. McCord	H. Arnold	H. D. Schmidt	E. E. Jacobson	H. C. Bristol, H. N. Jernigan.
Michigan	E. E. Norman	C. R. Bird	M N. Gerardy	—	O. McCarthy, L. McQueen, R. Faust.
Minnesota	F. Seligman	J. A. Jensen	R. M. Finch	R. A. Thuma	E. Grime, A. Janzig, C. Elliott.
Missouri Valley	D. L. Maffitt	B. L. Ulrich	E. L. Waterman	N. T. Veatch	C. Alexander, C. Hoen, E. Mathews, L. Nelson, F. Rathert.
Montana	G. E. Atkinson	C. W. Eyer	H. B. Foote	R. N. Arnold	D. S. Thomas, Kurt Wiel
New England	S. S. Anthony	F. A. Marston	S. M. Ellsworth	W. J. Scott	H. W. Griswold, P. A. Shaw.
New Jersey	W. R. Conard	G. F. Wieghardt	H. N. Lendall	S. F. Newkirk	J. A. Carr, C. H. Capen.
New York	E. L. H. Meyer	F. Henshaw	R. K. Blanchard	A. D. Drake	C. R. Cox, E. K. Wilson.
North Carolina	J. W. Kellogg	R. A. Thomas	A. R. Hollett	H. G. Baity	G. S. Moore, A. O. True, W. E. Vest.
Ohio	W. R. LaDue	W. C. Lawrence	T. R. Lathrop	—	C. Inman, P. Burgess, M. Hoffman.
Pacif. Northwest	N. A. Gilman	T. H. Judd	F. Merryfield	M. H. McGuire	R. E. Koon, M. K. Snyder
Rocky Mountain	O. J. Ripple	—	B. V. Howe	P. S. Fox	K. W. Caldwell, O. B. Summers, B. G. Coy, J. P. Soderstrum, K. F. Darling, L. O. Williams.
Southeastern	C. P. Townsend	P. Weir	B. P. Rice	D. R. Pringle	F. G. Crow, M. G. Stewart, J. H. McLure, H. F. Wiedeman
Southwest	T. L. Amiss	A. R. Davis	L. A. Quigley	H. E. Nunn	R. W. Harding, L. A. Jackson, A. F. Theard, M. T. Vanlandingham.
Virginia	H. A. Johnson	W. G. Myers	H. W. Snidow[2]	H. B. Rice	E. Meredith,[2] R. Leveque.
Wisconsin	W. U. Gallaher	W. C. Staeffler	L. A. Smith	C. Gruetzmacher	A. E. Hintz.

[1] For Section's representative on the A. W. W. A. Board of Directors, see list on page ii
[2] Virginia Section—Secretary is H. W. Snidow; Treasurer E. C. Meredith

COMING MEETINGS

Sept. 22–23—New York Section, at Nelson House, Poughkeepsie, N. Y. Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

Sept. 29–Oct. 1—Minnesota Section, at Hotel Nicollet, Minneapolis, Minn. Secretary, R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

October 6–7—Four States Section, at Raleigh Hotel, Washington, D.C. Secretary, Carl A. Hechmer, Washington Suburban Sanitary District, Hyattsville, Md.

October 10–12—Wisconsin Section, at Plankinton Hotel, Milwaukee, Wis. Secretary, L. A. Smith, City Hall, Madison, Wis.

October 13–15—Missouri Valley Section, at Hotel Fort Des Moines, Des Moines, Iowa. Secretary E. L. Waterman, University of Iowa, Iowa City, Iowa.

October 13–15—West Virginia Section. Organization Meeting at Morgantown, W. Va.

October 17–20—Southwest Section, at Hotel Biltmore, Oklahoma City, Okla. Secretary, L. A. Quigley, Supt., City Water Works, Fort Worth, Texas.

October 21–22—New Jersey Section, at Berkeley-Carteret Hotel, Asbury Park, N. J. Secretary, H. N. Lendall, Rutgers University, New Brunswick, N. J.

October 26–29—California Section, at Mission Inn, Riverside, Calif. Secretary, Carl M. Hoskinson, Div. of Water, Sacramento, Calif.

October 31–Nov. 2—North Carolina Section, at King Cotton Hotel, Greensboro, N. C. Secretary, A. R. Hollett, Box 281, Chapel Hill, N. C.

April 12–14—Canadian Section, at Royal York Hotel, Toronto, Ont. Secretary, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

CHANGES IN MEMBERSHIP

New Members, Applications Received July 1 to 31, 1938

BARDO, W. M., JR. Mgr., State College Water Works, Borough Offices, State College, Pa.

BEQUER Y HERRERA, GUSTAVO A. San. Engr., Public Health Service, Calle 4 #305, entre 13 y 15, Vedado, Havana, Cuba.

BIGELOW, WILLIAM RUSSELL. Dist. Mgr., Western United Gas & Electric Co., 1015 Chestnut St., Murphysboro, Ill.

BOMBIN Y CAMPOS, JOSE. Engr. in Charge of Water Supply, Public Water Dept., Jefatura de Obras Publicas, Camaguey, Cuba.

CALCAVECCHIA, STEFANO. Cons. Engr., San Juan de Dios, 3, Havana, Cuba.

CITY OF FERGUS FALLS. Water Dept., Mr. Joseph E. Young, Supt., Fergus Falls, Minn. (Corp. M.)

DOCAL, ANTONIO T. Civil Engr., Calle 14 No. 353 Vedado, Havana, Cuba.

FRELLES Y DUELO, ERNESTO E. Chief Bacteriologist, Havana Water Works, Havana, Cuba.

GAFFNEY, L. V. Supt., Water Dept., Gaffney, S. C.

GIQUEL, R. SANCHEZ. Engr. State Water Works, Dept. of Public Works, Calle 27 #117-Vedado, Havana, Cuba.

DE GOICOECHEA, LEANDRO. Asst. Professor, University of Havana, Havana, Cuba.

GRANDA Y DEBEN, ROBEL. San. Engr., Public Health Service, Estrada Palama 214 esq. a Concejal Veiga: Vibora, Havana, Cuba.

HARTUNG, H. O. Chemist, St. Louis County Water Co., 6600 Delmar Blvd., University City, St. Louis, Mo.

HERNANDEZ, JUAN A. Engr. of Secretaria de Sanidad & Salubridad Publica, Instituto Finlay, Havana, Cuba.

KELLER, S. K. Gen. Supt., Pinellas County Water System, Clearwater, Fla.

KELSEY, REGINALD A. Aqueduct Patrolman-In Charge, Dept. of Water & Power, Box 188, Mojave, Calif.

MARTINEZ, SERGIO S. Asst. Prof. Hydraulic & San. Eng., University of Havana, Calle H. No. 354, Vedado, Havana, Cuba.

MCCLEES, JOSEPH H. Water Meter Repairman-In Charge, Bureau of Water Works & Supply, 468 Ducommun St., Los Angeles, Calif.

MENZENHAUER, FRED C. Asst. Chemist, New York Water Service Corp., 515 Ocean Ave., Brooklyn, N. Y. (Junior M.)

MYERS, HENRY C. Chief Operator, California Water & Telephone Co., Route 1, Box 120, Palm City, Calif.

RAUSCH, CLAIR C. JR. San. Chemist, 2560 Harding Ave., Detroit, Mich.

ROBINSON, T. C. Supt. Light & Water Dept., Granite Falls, N. C.

TOMLINSON, W. J. Chemical Engr., Wood Industries Supply Co., 2007 Royal Bank Bldg., Montreal, Que., Canada.

TRAVERSE CITY IRON WORKS. Mr. H. O. Joynt, Pres., Traverse City, Mich. (Asso. M.)

VALLEE, ANTONIO. San. Engr., Public Health Service, Galiano 43 Segundo piso, Dept. 5, Havana, Cuba.

VAN AUSDALL, H. E. Engineering Draftsman, 719 Westbourne Drive, West Hollywood, Calif.

VAN BRUNT, J. K. Borough Supt., Water & Sewer Depts., 25 Union Avenue, Manasquan, N. J.

WRIGHT, GEORGE E. Cons. Engr., 84 Pine St., Corning, N. Y.

Reinstatements (Active)

ASHLINE, ROBERT R. Electrolysis Engr., Bureau of Water Works & Supply, 510 E. 2nd St., Los Angeles, Calif.

NEWS OF THE FIELD

Clippings from the country's newspapers indicate that many communities, both large and small, are taking advantage of the current recovery program and planning new water works or additions to old plants. Chicago's south side filter plant at last seems definitely under way. Hammond, Ind., is moving to lessen the sewage pollution of the lower end of Lake Michigan by building a sewage disposal plant.

Toledo has voted to build a new source of supply works and take the water from Lake Erie. Arcanum, Ohio, is planning an iron removal plant. St. Marys, Ohio, wants a new standpipe. Plainfield, Indiana, is considering water softening. Jacksonville, Ill., plans a raw water impounding reservoir, softening of the supply, and extensions to water mains. Litchfield, Ill., will make long needed repairs to the dam at the city reservoir. Wellsville, Ohio, will completely meterize the system. Fairbury, Ill., will extend the mains to get rid of dead-end troubles and relieve the housewives of the city, who "endanger their chances of a restful hereafter every time they turn on a water faucet." Shelby, Ohio, is voting on water softening. Evansville, Ind., is adding pumps, generators, mains, valves, and filter equipment. A flood wall is also included for protection against future inundation by the Ohio River. Frazeysburg, Ohio, is voting on the proposal to build a water works.

And so on across the country, the record of current activities in these three states is being duplicated. Inquiries made to A.W.W.A. headquarters for advice are being answered as fully as possible and then referred to the various state sanitary engineers to follow up.

Tying in dead ends of water mains and installation of distribution system valves is a form of water works improvement many cities are overlooking. Water main cleaning and water waste surveys are both fruitful methods of improving operating conditions. Water waste surveys especially offer a sensible method of attaining real economy of operation. There are cities in the U.S. that do not account for the sale of more than 60 per cent of the water pumped. The seat of such losses can be disclosed by a well planned waste survey. When the repairs are made, water will be saved and operating costs materially reduced. The municipal water works superintendent who does not find some way to set his house in better order by use of P.W.A. or W.P.A. funds either has a perfect plant (which is not likely) or is failing to live up to his responsibilities and opportunities.

Let us hope that no A.W.W.A. member nor any water works man who reads this is in the latter class.

(Continued on page 2)

(*Continued from page 1*)

Reprints of the "Standard Specifications for Laying Cast-Iron Pipe" are now available at 15¢ per copy or at the rate of 12¢ per copy for ten or more copies at a single mailing. The reprints are available in two sizes. A 6 x 9-inch (size of Journal page) edition is available for general use. An 8½ x 11-inch size has been printed for use as a part of contract documents. Members should designate which form they wish and, unless the order is for ten or more, payment should be forwarded with the order so as to eliminate billing expenses.

The American Public Health Association will hold its 67th annual meeting at Kansas City beginning October 25. The meetings and exhibits will be held in the Municipal Auditorium and three hotels will be used jointly as residence headquarters. The technical program includes quite a few items of interest to water works men. Prof. Dawson will discuss "Venting of the Plumbing Drainage System." "The Expanding Field of Public Health Engineering" will be the theme of an entire session. Committee reports on methods of water examination, stream pollution control, and similar subjects have a related interest to many A.W.W.A. members.

Two A.W.W.A. members formerly in the operating field will enter the university teaching field this month. J. B. Baty, once attached to the engineering staff of the New Jersey State Board of Health and recently Sanitary Engineer in the Technical Service Department of the Pennsylvania Salt Company, associates himself with the faculty of Queens University at Kingston, Ontario.

C. E. Perkins, former superintendent of the Water Company at Bartlesville, Oklahoma, will carry on for E. R. Stapley (also an A.W.W.A. member) as professor of civil engineering and field sanitary engineering at Oklahoma A. & M. College at Stillwater while Professor Stapley enjoys a sabbatical year in graduate work at Harvard.

An exchange arrangement has been perfected by the headquarters staff which makes available to A.W.W.A. members the "Weekly Bibliography of Pure and Applied Science" of the British Science Museum. Classifications listed include engineering, hygiene, water power, foundry practice, and sanitary engineering, as well as many others of general scientific interest. The listings are made weekly from world-wide periodical sources—of which the A.W.W.A. JOURNAL is one. Members may consult the files at headquarters or may study them at their own convenience upon payment of postage charges.

(*Continued on page 4*)

Nothing takes the place of a
RUDDER
Nothing takes the place of
CAST IRON PIPE

FROM the caravels of Columbus to the "Queen Mary," there has been no substitute for a ship's rudder. Since 1664, nothing has taken the place of cast iron pipe as an economical, long-lived material for underground mains.

If you want proved long life and low maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—and permanently tight joints—then you will agree that nothing takes the place of cast iron pipe. Some materials meet some of these requirments but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE
The Standard Material Q *for Underground Mains*

(*Continued from page 2*)

"Apparently the teachings regarding improved customer relations made a deep impression on Meter-man Leo Wilson, of the Cairo Water Company. For recently, after being asked to take special interest in answering a call of an exacting lady customer, Leo, next day, made out the following report:

'Work Order No . . .

(Changing elevation of meter box top in front of house, to permit lawn improvement work.)

Raised meter and meter box. Put new shut-off in box. Reseeded lawn. Swept off sidewalk. Cleaned out roof gutters. Hauled away excess earth. Took lady's dog for a walk. Answered long list of miscellaneous questions. Tried to be very courteous. Smiled and smiled and smiled.'

"All in a day's work, for a fact" states "Water," the house publication of the American Water Works and Electric Company.

(*Continued on page 6*)

Speed up
your PIPE JOINTING

No need to wait days for leaks to heal. Made with Tegul-MINERALEAD joints meet any reasonable leakage specification at once. Trenches can be backfilled and premises cleared up • Joints are permanently tight • The 10 lb. ingots are easy to ship, store and handle; impervious to water—can be stored outdoors. Correctly mixed at plant, *this* compound cannot change composition in transit to the job.

A Tegul PRODUCT

Tegul

MINERALEAD

for Quick Sealing, Permanently Tight Bell and Spigot Joints

For booklet, address

The ATLAS MINERAL Products Company *of Pennsylvania*

Mertztown . . . . Pennsylvania

IMPORTANT

The Association has run short of certain numbers of the Journal. Any member possessing a copy of any of the following issues which he does not wish to keep should advise this office. We will pay 50¢ each for copies to meet the demands of new members.

May	1930
April	1936
January	1937
February	1937
October	1937
January	1938

IF YOU HAVE A COPY AVAILABLE, JUST DROP US A POST CARD.

American Water Works Association
22 East 40th St., New York

VALVES *be Seated!*

TO good-natured Charlie Elstrodt, every chlorine cylinder valve is leaky until his own "personal" test proves it is tight. Because of Charlie's hard-boiled philosophy, because of the sureness of the compressed air test, mighty few leaky valve seats get by Charlie's inspection.

Charlie's job is one of about nineteen different steps in the cleaning, reconditioning and inspection routine through which Mathieson Chlorine cylinders and valves must pass before they are shipped. And in each of these operations it is men like Charlie Elstrodt, men who keep their eyes "glued on the ball", who give Mathieson's cylinder routine the backbone which makes it valuable to you

Mathieson engineers produce chlorine of a purity second to none; and Mathieson workmen see that you get this pure product in clean, smooth-functioning containers. Couple with this Mathieson's unusual service facilities and you see why this company presents a chlorine team that is hard to beat.

The MATHIESON ALKALI WORKS
(Inc.)
60 East 42nd Street New York, N. Y.

Soda Ash . . . Caustic Soda . . . Bicarbonate of Soda . . . Liquid Chlorine . . . Bleaching Powder . . . HTH and HTH-15 . . . Ammonia, Anhydrous and Aqua . . . PH-Plus (Fused Alkali) . . . Sulphur Chloride . . . CCH (Industrial Hypochlorite) . . . Dry Ice (Carbon Dioxide Ice) . . . Analytical Sodium Chlorite.

MATHIESON CHLORINE

"Everybody smiles when they use Activated Alum or Blackalum."

We of Activated Alum Corporation want to thank all of you for switching to Activated Alum and Blackalum—your acceptance of these two products is very gratifying.

Samples and information gladly sent upon request

Now used in the Water Plants managed by the biggest names in Water Works practice.

AN INDEPENDENT ALUM COMPANY

Activated Alum Corp.

OFFICE
80 Broad Street
New York City, N. Y.

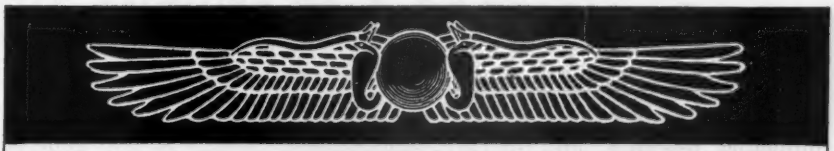
WORKS
Curtis Bay
Baltimore, Maryland

(*Continued from page 4*)

The Pennsylvania Salt Company has issued Data Book No. 2 on liquid chlorine,—a book that should be in the hands of every purification plant operator who is on his toes for valuable ideas. It is a fine example of good printing and was produced under the direction of Miss I. J. Dennery, who is the very capable advertising manager of the company. The technical information in it was prepared by A.W.W.A. Member Hedgepeth and includes data on testing chlorine not previously available. The section on handling chlorine leaks should be committed to memory by every chemist and chlorinator operator. Needless to say, they should also follow the rules there outlined. Copies may be had for the asking.

"The quest for better government in cities is largely a quest for better municipal administration." These are the opening words of a résumé of association activities issued by the Philadelphia Bureau of Municipal Research. The résumé epitomizes so much of interest to this association that it is quoted herewith freely.

(*Continued on page 8*)



WORTHINGTON
EQUIPMENT FOR WATER SUPPLY

CENTRIFUGAL PUMPS	STEAM AND POWER PUMPS
DEEP WELL TURBINE PUMPS	SUMP AND DRAINAGE PUMPS
DIESEL ENGINES	GAS ENGINES
STEAM CONDENSERS	CONDENSER AUXILIARIES
FEEDWATER HEATERS	STEAM-JET EJECTORS
STATIONARY AIR COMPRESSORS	PORTABLE AIR COMPRESSORS
ROCK DRILLING EQUIPMENT	CONSTRUCTION AIR TOOLS
V-BELT DRIVES	AIR LIFTS
STEAM TURBINES	REDUCING AND INCREASING GEARS

●

WATER METERS

A complete line of water meters of every type is manufactured by Worthington-Gamon Meter Company, a subsidiary of Worthington Pump and Machinery Corporation.

● ***Descriptive literature on any of these products furnished on request***

WORTHINGTON PUMP AND MACHINERY CORPORATION
WORTHINGTON-GAMON METER COMPANY
General Offices: HARRISON, NEW JERSEY *District Offices and Representatives in Principal Cities*

CDB-7C

(Continued from page 6)

"For this objective (better municipal administration) many groups are striving, among them business organizations, civic agencies, bureaus of municipal research, and private foundations. What is not generally known is the extent to which the public administrators themselves, through national associations of their own, are working for higher standards of municipal administration.

"Under the significant heading, 'Professionalization of the Municipal Service,' the Municipal Year Book for 1938 lists 18 such associations, with the dates of their founding. These are the American Association of School Administrators, 1865; American Public Health Association, 1872; International Association of Fire Chiefs, 1873; American Library Association, 1876; American Water Works Association, 1881; International Association of Chiefs of Police, 1893; American Public Works Association, 1894; American Institute of Park Executives, 1898; Civil Service Assembly of the United States and Canada, 1906; Municipal Finance Officers' Association of the United States and Canada, 1906; National Recreation Association, 1906; International City Managers' Association, 1914; Governmental Group, National Association of Purchasing Agents, 1924;

(Continued on page 10)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

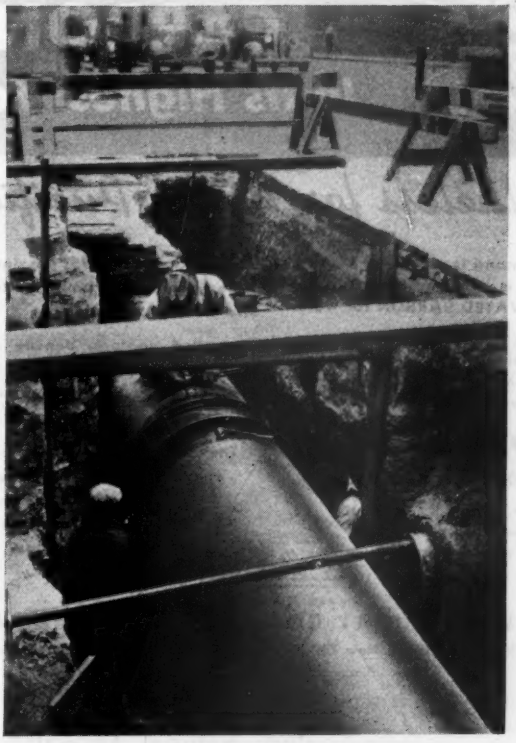
Hand Operated—size 2", 2½", 3", 4"
Power Operated—size 3" and 4"
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

THE ANSWER TO A PROBLEM

ALCO PIPE FOR CHICAGO



Cities using ALCO STEEL PIPE include the following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W Va
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elisabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y
New Brunswick, N.J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

The Water Department of Chicago and the Chicago Union Station were jointly and seriously concerned about the material to use in the 36" line to replace pipe running under the tracks of the station. The answer, illustrated above, is Alco Electric Welded Steel Pipe. No further need to worry about disastrous breaks.

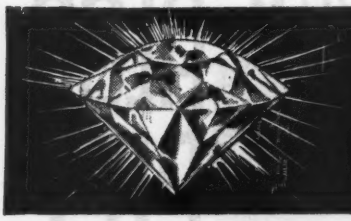
ALCO FEATURES

Greater Strength
Longer Life
Smoother Waterway
Longer Lengths
Fewer Field Joints
Low Initial Cost
Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS DIVISION
30 Church Street New York, N. Y.
CHICAGO WASHINGTON PITTSBURGH HOUSTON TULSA
Plants at Dunkirk, N. Y., and Montreal, Canada
Cable Address: Alproducts

AMERICAN LOCOMOTIVE COMPANY



CARBON
In Its Highest Form

But Valueless for Water Purification

Although the diamond is carbon in its most valuable form, it is worthless compared to CLIFFCHAR ACTIVATED CARBON for water purification.

Leading municipalities place high value on CLIFFCHAR to remove objectionable taste and odors from water supply.

CLIFFCHAR "R"
Special Grade for Water Purification

Low phenol value, shown by standard phenol tests, gives high ability to remove phenolic and similar compounds.

Extreme fineness (99% passing a 325 mesh screen) gives maximum surface exposure and adsorptive capacity.

Controlled, uniform density assures sufficient suspension period to take full advantage of its high adsorptive ability, yet settle out in ordinary settling basins.

The technical and laboratory facilities of this company are available without obligation to those concerned with taste and odor problems in water purification. Your inquiry is invited.

Cliffs Dow

REG. U. S. PAT. OFF.

CLIFFS DOW CHEMICAL COMPANY, Marquette, Michigan

Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Sts., St. Louis; Field Bldg., Chicago

(Continued from page 8)

American Welfare Association, 1930; National Association of Housing Officials, 1933; American Society of Planning Officials, 1934; Institute of Municipal Law Officers, 1934; and National Association of Assessing Officers, 1934.

"Each of these associations has as its main objective the improvement of the quality of service rendered in its special field of public administration. For example, the American Public Health Association seeks to 'bridge the gap between our scientific knowledge of health as discovered in the research laboratory, and the actual performance in the municipal and state health agencies'; the American Water Works Association aims to 'advance the knowledge of the design, construction, operation, and management of water works'; and the American Society of Planning Officials strives to 'promote efficiency of public administration in land and community planning.' In no sense are these associations labor unions working primarily for the economic interests of their members.

"For the advancement of their objectives, these organizations engage in a variety of activities. All hold regional, national or international conferences for the discussion of mutual problems and the exchange of

(Continued on page 12)

Reinstalled

After 60 Years' Service

• Pictured above is a 30-inch diameter *riveted* steel pipe being relaid in Brown's Valley, after 60 years of satisfactory service near Magalia, California.

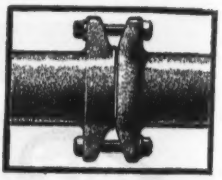
Other installations of rolled iron and steel pipe possess even longer service records. And remember, in those early days little was known about protective coatings for underground use.

Now with improved coatings and linings, plus wall thicknesses designed for individual conditions, modern Armco *Spiral Welded* Pipe will meet your requirements even more satisfactorily. You also gain increased flow capacity, low leakage loss and freedom from costly breakage. Write for the facts. The American Rolling Mill Company, Pipe Sales Division, 1211 Curtis St., Middletown, Ohio. Branch Offices in All Principal Cities.

ARMCO ARMCO **SPIRAL WELDED PIPE**

UNIVERSAL CAST IRON PIPE

LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

THE CENTRAL FOUNDRY COMPANY

General Offices: 386 FOURTH AVENUE, NEW YORK

CHICAGO, ILL., 1105 W. 36th St. - OAKLAND, CALIF., 278 Fourth St.

OFFICES IN PRINCIPAL CITIES COAST TO COAST

(*Continued from page 10*)

ideas, 16 of them holding annual conventions. All but 4 publish at least one periodical: 13 publish monthlies; 3 of those publishing monthlies also publish other periodicals—1 a semi-monthly, 1 a quarterly, and 1 both a semi-monthly and a quarterly; and 1 publishes a semi-monthly and a quarterly. Seven issue year books. To a greater or lesser extent, all render an information service to their members. Thirteen carry on research. From this and the work of special committees have come valuable reports and manuals of administrative procedure. A few of the associations give public-service training or cooperate with other agencies in such training."

Typhoid deaths in American cities in 1937 hit a new low of 0.76 per 100,000 population, according to the annual survey made by the Journal of the American Medical Association.

Since 1910, when typhoid deaths in the principal American cities were 20.54 per 100,000 population, the death rate has declined continuously. Twenty-seven cities in 1937 had no typhoid deaths. The survey embraced 78 large cities with an aggregate population of 36,771,787.

(*Continued on page 15*)

FIRST QUALITY METERS EXCLUSIVELY

SPECIFY *American* or *Niagara*

(BRONZE CASE) (IRON CASE)

Water Meters

WRITE FOR CATALOG

BUFFALO METER COMPANY

Established 1892 2914 Main St., Buffalo, N. Y.

APPLICATION FOR MEMBERSHIP
IN THE
AMERICAN WATER WORKS ASSOCIATION
22 East 40th Street, New York, N. Y.

Date:.....

.....hereby make application for
(I or We)

.....
(Active, Junior, Corporate or Associate Membership, or Affiliate)

in the American Water Works Association, and enclose herewith the sum of $....., one year's dues in advance.

Name.....

Company or Department.....

Title or Position.....

Address.....

.....

If application is for Junior Membership, give date of birth.....

If application is for Affiliate, state number of active services in property where employed .....

Nature of business or character of work (for office records).....

.....

.....

.....

.....

.....

.....

.....

.....

If application is for Corporate or Associate Membership, it must be signed by the person designated to represent the firm or corporation in A.W.W.A. activities.

.....
Signature of Applicant

(over)

ARTICLE I OF BY-LAWS

Section 3. An Active Member shall be a superintendent, a manager, an official or employee of a municipal or private water works; a civil, mechanical hydraulic, or sanitary engineer, a chemist, a bacteriologist, or any qualified person engaged or interested in the advancement of knowledge relating to water supplies. (Annual Dues, $10.00.)

Section 4. A Corporate Member shall be a Water Board, Water Commission, Water Department, Water Company or Corporation, National, State or District Board of Health, or other body, corporation or organization engaged or interested in water supply work, and shall be entitled to one representative whose name shall appear on the roll of members, and who shall have all the rights and privileges of an Active Member. This representative may be changed at the convenience and pleasure of the Corporate Member on written notice to the Secretary. (Annual Dues, $15.00.)

Section 5. An Associate Member shall be either a person, firm or corporation engaged in manufacturing or furnishing supplies for the operation, construction, or maintenance of water works. (Annual Dues, $25.00.)

Section 6. A Junior Member shall be an employee of a municipal or private water works; a civil, mechanical, hydraulic, or sanitary engineer, a chemist, a bacteriologist, a student or any otherwise qualified person engaged or interested in the advancement of knowledge relating to water supplies. At the time of his admission he shall be not less than eighteen years of age. His connection with the Association shall cease when he becomes twenty-five years of age, unless he is regularly enrolled as a student in a university or has previously transferred to the grade of Active Member. Junior Members shall receive the Journal and all privileges of Active membership except holding office and voting. (Annual Dues, $5.00.)

Section 7. An affiliate shall be any person otherwise qualified for Active membership who, at the time of application, is not nor previously has been a member of the Association and who, for acceptable reasons, does not wish to become an Active Member.

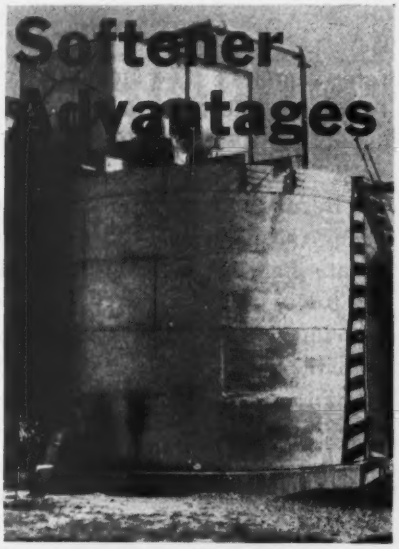
No corporation, firm or partnership which otherwise would be entitled to the grades of Associate or Corporate member may hold the grade of Affiliate. No employee of an Associate member may become an Affiliate. No person who is the superintendent, the manager, the chief engineer, the superintendent of filtration, the chief chemist, or the superintendent of distribution in a plant having more than 3,000 active services, is eligible for the grade of Affiliate. Under unusual conditions, exception to the above may be made by action of the Executive Committee if the applicant sets forth fully the reasons for the exception when applying for the Affiliate grade.

Affiliates shall not be entitled to vote upon general Association questions, and not eligible to hold office in the Association, nor in any of its Divisions. They shall be eligible to vote upon Section questions and to hold Section offices except those of Chairman, Vice-Chairman, Secretary (and/or Treasurer). They shall be entitled to all other rights and privileges of Active Members. Affiliates receive the March, June, September and December issues of the Journal each year. (Annual Dues, $4.00.)

Memberships will be dated as of the beginning of the quarter in which the application is received.

Membership in the Association carries, also with no additional dues, membership in its Local Sections and National Divisions, and includes the Journal, a monthly publication devoted to water works interest. The proceedings of the annual conventions and of the meetings of the Local Sections are published in the Journal, which also contains contributed articles on subjects pertaining to public water supplies.

The Accelator PROVES its Softener Advantages



The Infilco Accelator water softener at Georgetown, Tex., has *proved* its advantages over other processes. Construction costs were cut. Operating expenses are less. Water is delivered with lower hardness and turbidity.

The Accelator is the most important advance in water softening in recent years. It retains all of the advantages of the well-known lime process, but obtains results heretofore unobtainable, and within time and space believed impossible.

Write for literature describing the revolutionary Accelator softener.

INFILCO

INTERNATIONAL FILTER CO.

59 E. Van Buren St., Chicago, Ill.

WATER WORKS AND SEWAGE TREATMENT EQUIPMENT

(*Continued from page 12*)

The remarkable progress towards the eradication of typhoid fever in American cities since 1910 is one of the outstanding achievements of sanitary engineering and preventive medicine. This leads to the hope that the ill may in the not distant future be removed from the list of human ailments. Much of the progress in the conquest of the disease has resulted from improved methods and standards for the processing and handling of water and foods, and also from the development of corps of skilled water operators throughout the country.

The decline in deaths from typhoid fever has paralleled closely the use of chlorine for the sterilization of public water supplies, points out the water works association. The value of minute amounts of chlorine in safeguarding water was demonstrated about 40 years ago, but the adoption of water chlorination by cities at first progressed slowly. In 1910 there were only about 250 communities chlorinating their water. Automatic devices to apply chlorine to water supplies were perfected and in the following decade chlorination made great strides. By 1920 almost 2,000 communities were using chlorine. At the present time more than 6,000 communities in the United States are using chlorine to sterilize their

(*Continued on page 16*)

(*Continued from page 15*)

water supplies. The amount of chlorine used is so small that ordinarily it does not affect the taste of the water. It has no physiological effects. But it gets the typhoid germs.

Because of rapid advances made in the art and science of lighting during the past two years, and to provide a ready source of up-to-the-minute lighting facts for the illuminating engineer, the Westinghouse Lamp Division of the Westinghouse Electric & Manufacturing Company, announces a completely revised edition of its lighting handbook which is available at seventy-five cents a copy.

Titled "Artificial Light and Its Applications," the new edition is larger and much more comprehensive. Where the earlier edition contained but 7 chapters, the new contains 19, some of which are new, others of which are elaborations. Tables have been revised and the text has been simplified and profusely illustrated. Among some of the new chapters are those on Photometry, Color, Theatre Lighting, and Sports and Recreational Lighting.

(*Continued on page 18*)

DIFCO

Ingredients of Nutrient Agar

Bacto-Peptone is the standard peptone for all general purpose culture media. It is rich in readily available forms of nitrogen and has a reaction of pH 7.0 in a one per cent. solution. It is recommended as an ingredient of the standard nutrient agar for the plate count of bacteria in water.

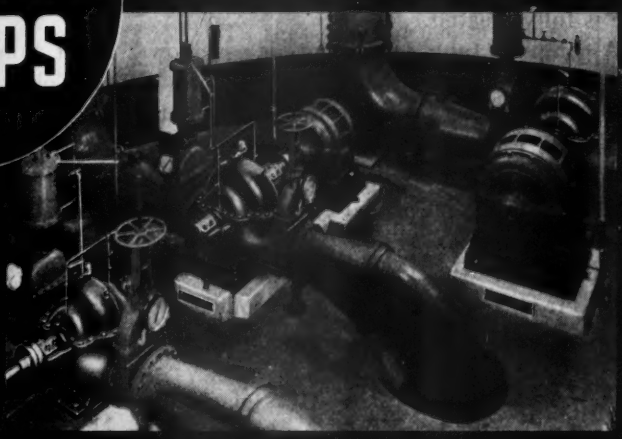
Bacto-Beef Extract is also recommended as an ingredient of nutrient agar. It has a reaction of pH 6.8 and is sparklingly clear in the concentrations usually employed for culture media.

Bacto-Agar may be used with Bacto-Peptone and Bacto-Beef Extract in preparing nutrient agar. When these products are employed the medium requires neither adjustment of its reaction nor filtration of the solution.

Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

DIFCO LABORATORIES
INCORPORATED
DETROIT, MICHIGAN

DE LAVAL FOR INSURANCE PUMPS



Three De Laval general service pumps supplying a great industrial plant; capacities 7600 g.p.m. against 54.5 ft.; 12,000 g.p.m. against 56 ft.; and 19,000 g.p.m. against 60 ft., respectively.

A $5,000,000 plant, using water in large quantities and operating 24 hours per day the year around, depends for its water supply upon the three De Laval pumps shown in the photograph, continuous operation being provided by connections to a reservoir and to a city water works system.

De Laval pumps are designed with particular regard to reliability in service, viz.

1. The casings are split horizontally in the plane of the axis, so that internal parts are readily accessible and renewable without disturbing piping.
2. Labyrinth wearing rings, which protect casing and impeller and restrict leakage from discharge to suction, give longer life and sustain efficiency over longer periods than do flat wearing surfaces.
3. Parts subject to wear, such as bearings, shaft sleeves, casing bushings, and wearing rings, are made to limit gages on an interchangeable basis, so that renewals do not require to be fitted and can be inserted quickly.
4. De Laval pumps are guaranteed as to efficiency and other characteristics and are tested before shipment from our works.

State your requirements so that we may send data and literature.

3205

DE LAVAL *Steam Turbine Co.*
TRENTON, N. J.

MANUFACTURERS OF STEAM TURBINES, PUMPS – CENTRIFUGAL, PROPELLER, ROTARY DISPLACEMENT; CENTRIFUGAL BLOWERS AND COMPRESSORS; WORM GEARS; HELICAL GEARS; HYDRAULIC TURBINES AND FLEXIBLE COUPLINGS • • • SOLE LICENSEE OF THE BAUER WACH EXHAUST TURBINE SYSTEM

(*Continued from page 16*)

Stressing the important part artificial lighting plays in eyesight conservation, space is devoted to the physiology of the eye and its reaction to light. The application of lighting in industry, commerce, and the home is fully treated.

A complete table of contents is as follows: Light Sources; The Language of Lighting; Photometry; Light and Vision; Color; Light Control; Interior Lighting Design; Industrial Lighting; School Lighting; Commercial and Public Building Lighting; Display Lighting; Home Lighting; Farm Lighting; Floodlighting; Recreational and Sports Lighting; Architectural Lighting; Electrical Advertising; Street and Highway Lighting; Lighting in the Theatre.

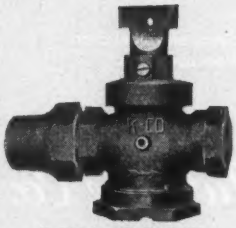
The book is 8½ x 11″in size and contains 258 pages. Copies may be obtained from any district or branch office of the Westinghouse Lamp Division, Westinghouse Electric & Manufacturing Company, at 75 cents each.

"**Proof of progress** in matters of cleanliness is to be found in comparing modern school requirements with those of a boarding school patronized by French nobility some two hundred years ago," records the

(*Continued on page 20*)

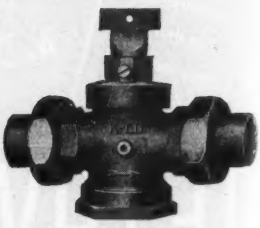
Quality Products by—

KITSON



C-170 Curb S. & W.
Inverted Key—Roundway
Inlet Copper Pipe Coupling
Outlet for Iron Pipe

C-168M—Curb Stop and
Waste
(Minneapolis Pattern)
Inverted Key—Roundway
for Iron Pipe



C-180 Curb S. & W.
Inverted Key—Roundway
Lead Flange Couplings
Both Ends

KITSON COMPANY
2409-15 WESTMORELAND ST., PHILADELPHIA, PA.

80% Saving

in fire hydrant collision repair costs

IMPACTS that would demolish any other type of fire hydrant merely fracture the inexpensive Safety Breakable Section of the Kennedy SAFE-TOP Fire Hydrant without injury to the major parts of the hydrant. The water pressure in the main keeps the inlet valve tightly closed so that there is no danger of flooding. No excavating is necessary, nor need the water service be shut off while awaiting or making repairs.

The only parts that need be renewed cost $6.00. They can be replaced by one man, with standard tools, in less than half an hour.

Write for Bulletin

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY SAFETOP FIRE HYDRANT

REG. U.S. PAT. OFF.

OVER 500 municipalities use American or New York Continental Jewell Water purification equipment.

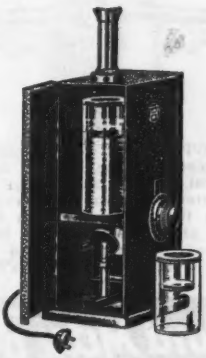
WATER FILTERS
WATER SOFTENERS

Proportionate Electro-Magnetic Chemical feeders for feeding lime, acid, alum, soda ash, etc.

AMERICAN WATER SOFTENER COMPANY
Lehigh Avenue and 4th St.
Philadelphia, Pa.

HELLIGE TURBIDIMETER

An accurate test requires only one minute. Reads all turbidities down to zero.



HELLIGE, INC.
[illegible] NORTHERN BLVD. LONG ISLAND CITY, N.Y.
SCIENTIFIC INSTRUMENTS · LABORATORY & BACTERIOLOGICAL SUPPLIES

(*Continued from page 18*)

Cleanliness Institute. "In its catalog to parents of prospective female pupils it included the following astonishing information:

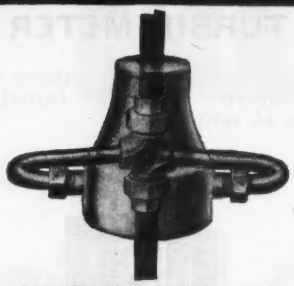
"Pupils are entitled to have one set of underclothing, one pair of stockings and two handkerchiefs per month. Towels: Pupils, one every week; nuns, one every two weeks. Foot baths: Pupils, one a month; nuns, only by special authorization of the superior. Complete baths: Three a year (May, June and July). Pupils unable to take their baths on the appointed day must wait until the following month."

After all, we do make progress.

Waste pickle liquor is to be made into insulation blocks in a new development placed in operation at the Sharon Steel Corporation works at Sharon, Pa. Spent pickle liquor, an end-product of steel production, has hitherto been of no use and has been treated only when obligatory before its discharge into streams. Allied Development Corporation, Cleveland, has developed this discovery, and Sharon Steel Corporation is the first licensee. Water works men may see streams rid of this form of pollution in the future for news of this commercial development follows

(*Continued on page 22*)

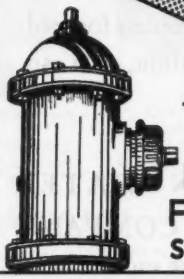
The Ford Copperhorn
MAKES AN IDEAL SETTING FOR METERS IN BASEMENTS



The COPPERHORN permits installing a water meter at the desired height in a vertical pipe. It provides an all-copper water way and maximum flow through the meter. It holds the customer's pipe connected and takes the curse out of meter changing. Let us tell you more about the COPPERHORN.

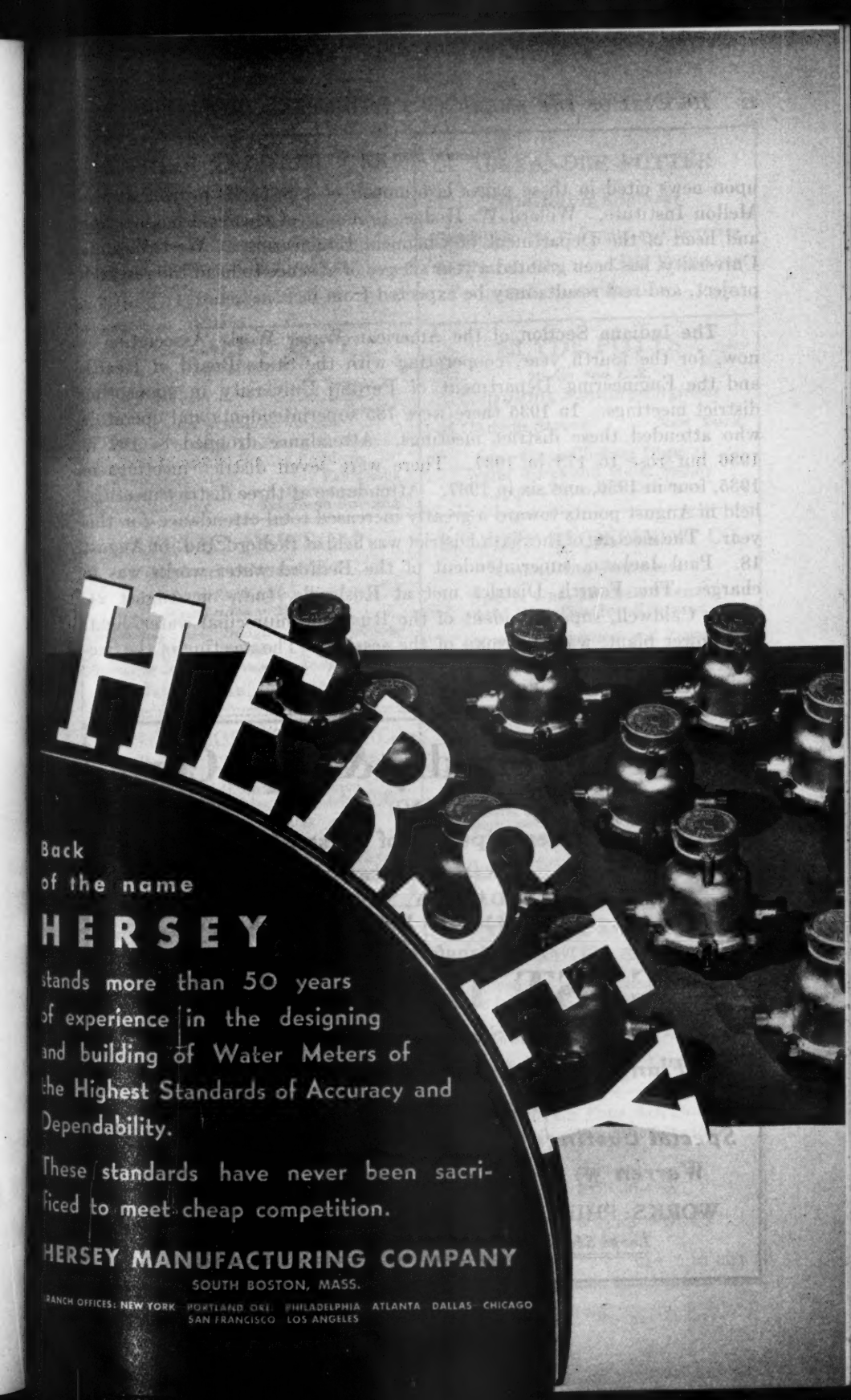
The Ford Meter Box Co.
WABASH, INDIANA

50 years of Production Experience back of KUPFERLE FIRE HYDRANTS



SEND FOR SPECIFICATION SHEETS

John C. KUPFERLE Foundry Co.
ST. LOUIS, MO.



Back
of the name

HERSEY

stands more than 50 years of experience in the designing and building of Water Meters of the Highest Standards of Accuracy and Dependability.

These standards have never been sacrificed to meet cheap competition.

HERSEY MANUFACTURING COMPANY
SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK PORTLAND ORE. PHILADELPHIA ATLANTA DALLAS CHICAGO
SAN FRANCISCO LOS ANGELES

(*Continued from page 20*)

upon news cited in these pages last month of a research project at the Mellon Institute. Willard W. Hodge, professor of chemical engineering and head of the Department of Chemical Engineering at West Virginia University, has been granted a year's leave of absence to head the research project, and real results may be expected from it.

The Indiana Section of the American Water Works Association is now, for the fourth year, cooperating with the State Board of Health and the Engineering Department of Purdue University in sponsoring district meetings. In 1935 there were 135 superintendents and operators who attended these district meetings. Attendance dropped to 102 in 1936 but rose to 173 in 1937. There were seven district meetings in 1935, four in 1936, and six in 1937. Attendance at three district meetings held in August points toward a greatly increased total attendance for this year. The meeting of the Sixth District was held at Bedford, Ind., on August 18. Paul Jackson, superintendent of the Bedford water works was in charge. The Fourth District met at Rushville, Ind., on August 24. James Caldwell, superintendent of the Rushville municipal water, light, and power plant, was chairman of the session. The meeting of the Sec-

(*Continued on page 26*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2" to 84"

Flanged Pipe *Flexible Joint Pipe*

Bell and Spigot Pipe

Special Castings *Short Body B. & S. Specials*

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

MORRIS KNOWLES, INC.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.
Pittsburgh, Pa.

ALEXANDER POTTER
Consulting Engineer
Specialties: Water Supply and Sewerage
50 Church St. New York City
Telephone 5501 Cortlandt

METCALF & EDDY
Engineers
Almon L. Fales — Harrison P. Eddy, Jr.
Frank A. Marston — Arthur L. Shaw
John P. Wentworth — E. Sherman Chase
Charles W. Sherman, Associate
Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories — Valuations
Boston, Mass. Statler Building — **Harrisburg, Pa. Telegraph Building**

CLYDE POTTS
M. Am. Soc. C. E.
Consulting Sanitary Engineer
30 Church Street - - New York
Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

REEVES NEWSOM
Engineer - Consultant
Supply, Purification and Distribution of Water
Operation — Design — Construction
Valuation — Rates — Negotiations
Investigations — Taxes — Accounting
500 Fifth Avenue New York City

SCOFIELD ENGINEERING CO.
Consulting Engineers
Water, Gas, Electric Plants and Distribution Systems
Appraisals, Valuations and Reports
Design—Supervision—Operation
Philadelphia, Penna.

PEASE LABORATORIES, INC.
39 West 38th Street, New York
Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.
Chemists Field Sanitary Surveys
Bacteriologists Consultants

WESTON & SAMPSON
Robert Spurr Weston **G. A. Sampson**
Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.
14 Beacon St. Boston, Mass.

MALCOLM PIRNIE
Engineer
Water Supply, Treatment, Sewerage,
Reports, Plans, Estimates,
Supervision and Operation
Valuation and Rates.
25 W. 43rd St., New York, N. Y.

WHITMAN, REQUARDT AND SMITH, *Engineers*
Ezra B. Whitman — Norman D. Kenney
Gustav J. Requardt — Robert T. Regester
Benjamin L. Smith — Theodore W. Hacker
WATER WORKS - SEWERAGE - UTILITIES
Baltimore, Md. Albany, N. Y.

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings
50 Church St. New York City

Help Build up Your Association by Bringing in a New Member
SEND FOR APPLICATION BLANK
AMERICAN WATER WORKS ASSOCIATION
22 East 40th St. NEW YORK CITY

(*Continued from page 22*)

ond District was held at Marion, Ind., on August 25. S. M. Van Cleave, superintendent of the Marion water works, was general chairman. Representatives of fifty water departments were at the meeting.

Frequent requests for originals of articles to which reference is made in the abstract section of the JOURNAL indicate the need for a more general understanding of the system used in assembling this material. While in some cases the abstracted publication is regularly received and filed in the headquarters office, many foreign publications are not. An exchange arrangement has been made with certain British publications (Bulletin of Hygiene and Water Pollution Research Bulletin) which allows the JOURNAL to repeat abstracts selected from their pages when proper credit is given. One regular abstractor is a resident of Germany and another a resident of England. In these cases, the publication abstracted may never be seen at A.W.W.A. headquarters.

If a publication is filed at headquarters or if it is available in a New York library, photostatic reproductions can be made at a cost generally

(*Continued on page 28*)

When you choose hydrants, be sure they deliver full flow at all times—eliminate surge and water hammer—break off above the ground, and can be replaced without digging.

Ludlow Hydrants do all that, and combine graceful design with low maintenance costs as well. Send for free folder.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

It makes NO difference to

% PROPORTIONEERS %

"Perchloron"
"HTH"
"Columbia"
"Wil-Chlor"
"Maxochlor"
"Purex"
"Chlorofectant"
"Chlorox"
"Isco"
"Kohnstamm"
"Clor-O-Mor"

Accurately fed by Chlor-O-Feeders, these chemicals have all been proved practical in chlorinating medium and small water and sewage plants; and even to sterilize big plants in emergencies.

% PROPORTIONEERS, Inc. %
18 Codding St., Providence, R.I.

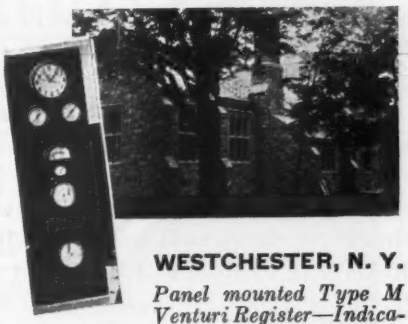
A. W. W. A. Membership Certificates

A fine newly designed parchment paper membership certificate for A. W. W. A. members is now available in 9 by 12 inch size, suitable for framing.

Give us your name—exactly as you wish it to appear. Send 40¢ in coins or postage to cover cost of lettering and mailing.

The certificate will reach you within 10 days of receipt of your order—ready for you to frame and hang in your office.

FLOW AND LEVEL METERS FOR THE COMMUNITY PLANT



WESTCHESTER, N. Y.

Panel mounted Type M Venturi Register—Indicator—Recorder at Rye Lake Pumping Station.

NEW ROCHELLE, N. Y.

Chronoflo Transmitters in the Metz Reservoir Gate House transmit water level to distant Chronoflo Recorders. Venturi Meter measures flow.

Experienced engineers and superintendents of small, large, and medium size plants choose Builders Venturi and Chronoflo Meters and Controllers to aid in maintaining initial efficiency and in keeping down cost of operation.

Bulletin 298 shows many new applications of Chronoflo Meters. Would you like it?

BUILDERS IRON FOUNDRY

"Builders of the Venturi Since 1891"

9 Codding St. Providence, R. I.

(*Continued from page 26*)

not greater than 50¢ per page. In certain cases, the office file copy of a publication can be loaned to an A.W.W.A. member, if he is willing to pay carrying charges.

The staff is anxious to cooperate fully with every A.W.W.A. member who wishes to extend to the utmost the values of the abstract section of the Journal. All abstracts have been run since January, 1937 under classified headings and, except in unusual cases such as those involving foreign publications, abstracts are run within 90 days after their original appearance.

This service can be extended to include the loan or photostat services, whenever a member makes a request.

During times of depression, older employes are preferred and continued on the payroll by most well-managed companies, declared A. W. Robertson, Chairman of the Board of the Westinghouse Electric & Manufacturing Company, speaking in Columbus, Ohio before the Veterans of Foreign Wars.

Mr. Robertson cited employment figures of his own company to show

(*Continued on page 30*)

CLEAN YOUR WATER MAINS

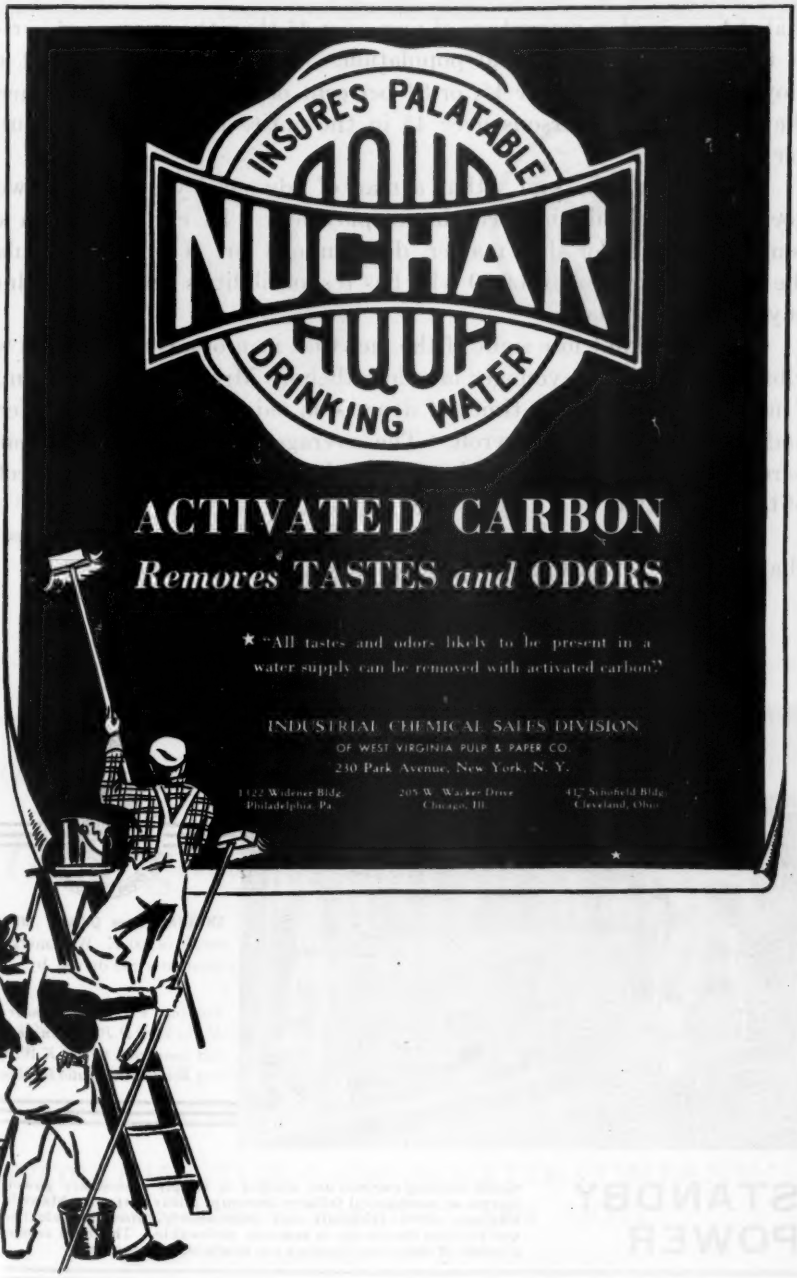
One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

50 Church St., New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.


INSURES PALATABLE
NUCHAR
DRINKING WATER
ACTIVATED CARBON
Removes TASTES and ODORS
★ "All tastes and odors likely to be present in a water supply can be removed with activated carbon."
INDUSTRIAL CHEMICAL SALES DIVISION
OF WEST VIRGINIA PULP & PAPER CO.
230 Park Avenue, New York, N. Y.
1422 Widener Bldg. Philadelphia, Pa.
205 W. Wacker Drive Chicago, Ill.
417 Schofield Bldg. Cleveland, Ohio

(*Continued from page 28*)

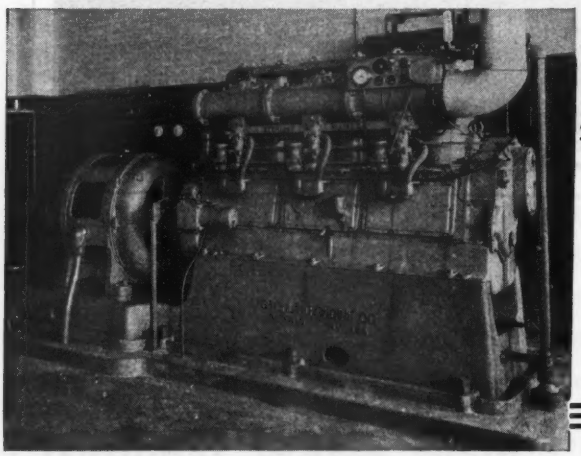
that it has a higher percentage of men over 45 than the average of persons of these ages in the general population. Westinghouse at present employs 12,410 persons over 45, or 31 per cent of the total payroll, whereas the number of all persons over 45 in the entire population is about 23 per cent.

"It is true," he said, "that a man of advanced years, out of work, does have a difficult time securing employment. He certainly has a kick coming—but so, for that matter, does anyone out of work, particularly the young married man of 30 who has responsibilities that match almost any 45-year-old man's."

"We shouldn't lose sight of the fact that men of advanced years with jobs hold them when younger men lose theirs," Mr. Robertson continued. "In other words, during times of depression older employes are preferred and continued on the payroll. The average organization has a larger percentage of people over 45 than will be found in an average cross-section of the population.

"After all, older men rule the world. It isn't reasonable to assume that they are leagued against the people of their own age.

(*Continued on page 32*)



Sterling

SHUSHAN (New Orleans) AIRPORT employs 200 K. W. Emergency Generator Set driven by

Sterling Viking 6-cylinder 425 H.P., 1200 R.P.M. Engine, direct connected to 200 K.W. General Electric Generator for standby.

STANDBY POWER

Quick starting engines are needed to supply emergency power when storms or mechanical failures interrupt utility current. Many Sterling Engines serve faithfully and immediately, providing electricity so quickly that the outage is scarcely noticeable. The data compiled as a result of these installations are available on request.

STERLING ENGINE COMPANY

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

Dept. C-3

Branch Office
900 Chrysler Bldg.
New York, N. Y.

WATCH DOG METERS

Frost-proof meter

Turbine meter

Investigate these meters

. . . more than 3,500,000 now in use

WHEN looking over your requirements, remember that thousands of municipalities are getting satisfactory low-cost service from Worthington-Gamon Meters.

WORTHINGTON-GAMON METER COMPANY

General Offices: HARRISON, NEW JERSEY

Offices and Representatives in Principal Cities

WORTHINGTON-GAMON

WG8-7

For maximum water revenue
with the lowest maintenance
for the longest period of time

Investigate **NATIONAL** *Meters*

NATIONAL METER COMPANY, 4207 First Ave., Brooklyn, N. Y.

(*Continued from page 30*)

"It seems to me that we must conclude that the problem of unemployment is a serious one, both to young and old, the cases varying in intensity with the individual. The trouble is, older people usually get the notion that they can do only one thing well and that is what they want to do. It often happens that the world is well supplied with people to do the same kind of work they like to do. Or perhaps the line of work has ceased to be needed at all. The older man out of a job must be willing to start all over again, and if he is willing he will most certainly find his opportunity."

Mr. Robertson, who is a member of the committee on the problem of the older worker recently appointed by the Secretary of Labor, reported that much valuable information is being obtained by the committee, and "it is hoped that worthwhile conclusions may be reached."

"One thing of which we may be certain," he said, "is that industry is not hostile to the older man, assuming that he is willing and well. He is usually more steady, more careful and reliable, and has as good or better health than the younger man, and is generally an entirely desirable type of employe."

(*Continued on page 34*)

EVERSON STERILIZING APPARATUS

Feeds, Measures and Mixes Chlorine Gas

A complete line of new and better apparatus for controlling, feeding and mixing chlorine gas, ammonia, etc. into solutions—for sterilizing drinking water, sewage or swimming pools.

Write for Bulletin and Catalog of Swimming pool equipment and Supplies.

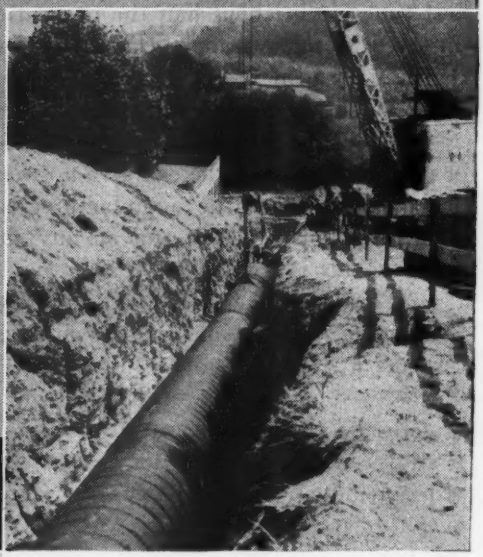
EVERSON MANUFACTURING CO.
"The Swimming Pool People"
221 W. Huron St., Chicago, U. S. A.

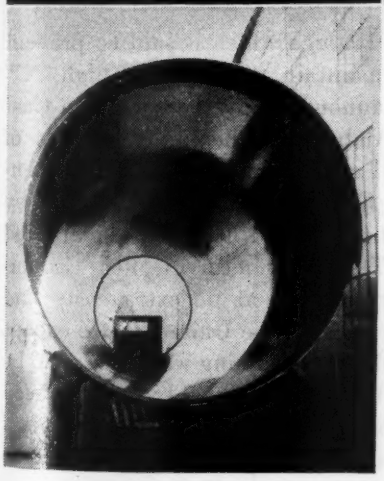
JOURNAL

If you have any old copies of the Journal you would like to dispose of, see page 4.

AMERICAN WATER WORKS ASSOCIATION

NEITHER HEAT NOR COLD affect the DEPENDABLE PROTECTION of Reilly PIPE ENAMEL AND PRIMER





● Not only on major water works and pipe line transmission projects, such as those shown on this page, but on "everyday" pipe line and conduit installations throughout the country, REILLY PIPE ENAMEL and PRIMER are widely used for protection against corrosion, tuberculation and destructive agencies. REILLY ENAMEL provides a coating that resists abrasion and withstands a wide range of temperatures—from 200° F. to —20° F. It will not sag or flow at high temperatures, nor crack or chip at low temperatures. Easily and economically applied by all usual methods. For absolutely *dependable pipe line protection*, insist upon *Reilly Pipe Enamel and Primer.*

Reilly COAL TAR PRODUCTS

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN · PLANTS · TO · SERVE · YOU

(*Continued from page 32*)

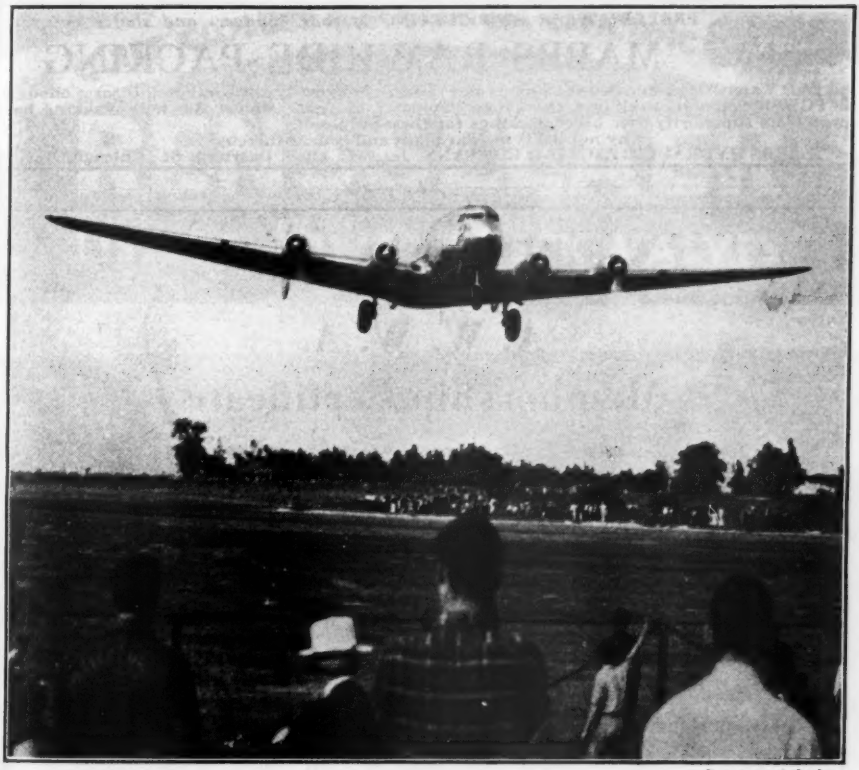
The whole problem of unemployment is one that is usually laid at industry's door, and unfairly so, Mr. Robertson continued. Even in the best times, only about half the population is engaged in business and industry. Manufacturing actually engages in good times considerably less than 25 per cent of the population, so it can hardly be responsible for all the country's unemployment.

"The manufacturer offers his goods for sale, and if they are not bought or used by the public he can give no work," he explained. "It is idle for demagogues to tell the manufacturer to employ men when there is no work. No business can run on any such basis, and it takes little wit to know this is true.

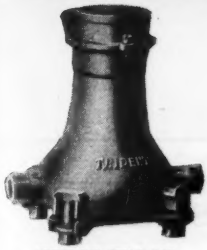
"This doesn't change the fact, however, that men out of work are a problem which should cause everyone concern. And industry is concerned. Its employes are its first concern because it knows that it has no life or existence except through them. It values them above its customers and delays posting the notice that there is no work as long as possible. It pays wages long after dividends are discontinued. Well-ordered industry started pensions and welfare long before government ever thought of such a thing."

New lining for Cast-Iron Pipe and Fittings which is said to prevent tuberculation, reduce friction of flow, maintain permanently high "C" values, and minimize pumping costs, is announced by the American Cast Iron Pipe Company of Birmingham, Alabama. The lining consists of two coats of cement and a finishing seal coat of asphalt paint; it is centrifugally applied to regular Mono-Cast Centrifugal Pipe, and applied by hand to the fittings. When so lined, the pipe and fittings are marketed under the trade-name "Enameline." The manufacturers offer "Enameline" as an alternate for standard tar coating—at no extra cost—and recommend it for water main service throughout the United States except in very special cases where additional thickness of lining would seem to be desirable. In the "Enameline" process, the pipes are lined by an improved centrifugal lining process combined with troweling action which assures a thorough and uniform distribution of cement mortar evenly throughout the inside surfaces of the entire length of the pipe; Fittings are "Enamelined" by hand to produce linings approximately equal to those of the pipe. In the "Enameline" process the cement mortar is introduced inside the pipe by means of a hollow tube which houses a conveyor screw. One

(*Continued on page 38*)



Courtesy Aviation



FROST PROOF
With Breakable Bottom
Sizes ⅝" to 1"

CREST
for high rates of flow
Sizes 1½" and 2" Screw End 1½" to 16" Flange End

"That ship reminds me of Trident Water Meters . . . . pioneers of progress and triumphs of modern precision equipment"

NEPTUNE METER CO., 50 WEST 50TH ST., N. Y. C.
NEPTUNE METERS LTD., 345 SORAUREN AVE., TORONTO

TRIDENT

Trade Mark MABBS Reg. U. S. Pat. Off.

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.
Why not use it in your plant and benefit thereby?
MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

A. W. W. A.
Membership Certificate

A fine newly designed parchment paper membership certificate for A. W. W. A. members is now available in 9 by 12 inch size, suitable for framing.

Give us your name—exactly as you wish it to appear. Send 40¢ in coins or postage to cover cost of lettering and mailing.

The certificate will reach you within 10 days of receipt of order —ready for you to frame and hang in your office.

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.
Lawrenceburg — Indiana

WELL SCREENS

To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.
2304 Long Avenue,
St. Paul, Minn.

SAVE 80% ON YOUR TRENCHING COSTS WITH A
GIANT PIPE PUSHER

10 DIFFERENT SIZES
TO FILL EVERY NEED
WRITE FOR CATALOG
Dept. P-3
GIANT MFG. CO.
Council Bluffs, Iowa

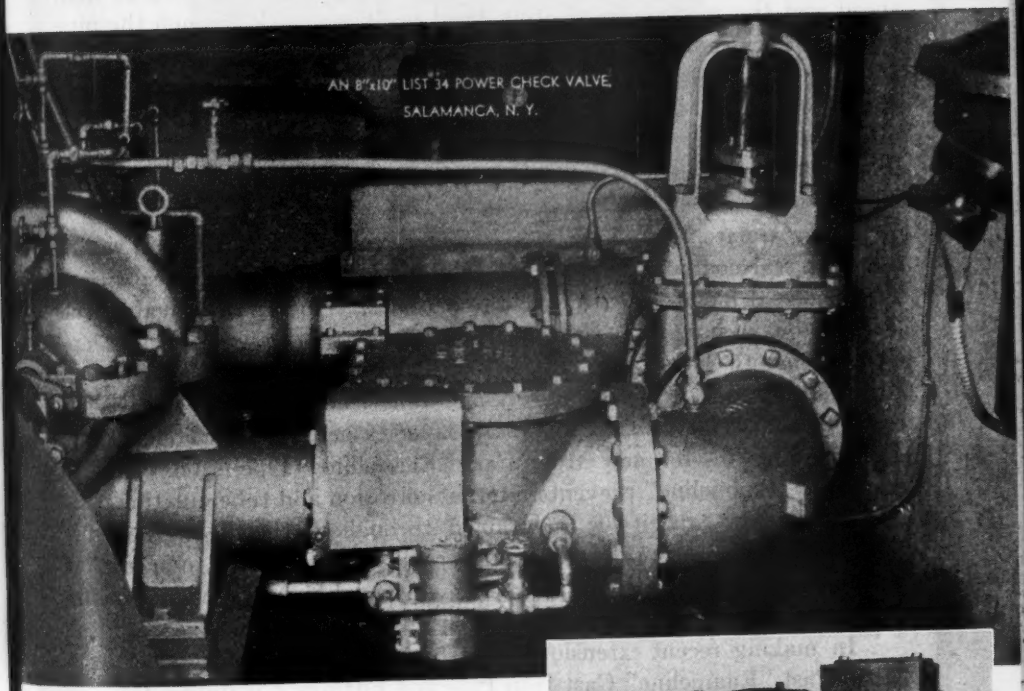
Oceans of Water

POMONA PUMPS
WATER LUBRICATED TURBINE
POMONA PUMP CO.
POMONA, CALIFORNIA
LOS ANGELES 406 S. MAIN ST. CHICAGO 53 W. JACKSON BLVD.

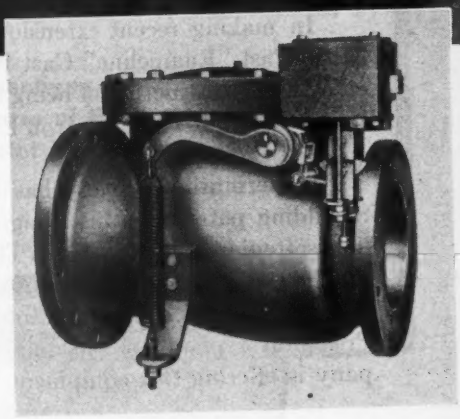
FOR QUIET CLOSURE & MAXIMUM EFFICIENCY—INSTALL

RENSSELAER

LIST 34 POWER CHECK VALVES



AN 8"x10" LIST 34 POWER CHECK VALVE
SALAMANCA, N. Y.



Positively eliminates slam on pump shut-down.

Full clearway opening reduces head loss and cuts power costs.

Simplicity of design and rugged construction results in trouble-free operation over a period of years.

Bulletin "V" mailed on request

RENSSELAER VALVE COMPANY, TROY, N. Y.

(*Continued from page 34*)

end of this tube is fitted with a distributor head through which the mortar is forced out by the conveyor screw. The distributor head is equipped with flexible troweling shoes, which spread the mortar thoroughly, evenly and uniformly on the wall of the pipe. The Mono-Cast Centrifugal Pipe is revolved as the first coat of cement mortar is uniformly troweled onto the wall and effectively bonded to the bare metal pipe surface. Immediately following this initial application the pipe is accelerated to high speed and the mortar distributing head is drawn back through the pipe applying the second coat on top of the first, thus eliminating all voids and producing a cement mortar lining $\frac{1}{16}''$ thick, thoroughly compacted and of uniform thickness. The high speed of revolution of the pipe is maintained for a few seconds after the distributing head is out of the pipe in order to impart a "float" finish to the inside surface of the lining, giving it exceptional smoothness.

Approximately one hour later, while the cement mortar is still wet, a finishing seal coat of asphalt paint is applied with a 360-degree spray. This seal coat facilitates curing and protects the cement lining against the leaching out of lime when exposed to extremely soft waters. The exceptionally smooth "float" finish of the interior surface of Mono-Cast "Enameline" Pipe reduces friction losses, maintains the pipe's initial carrying capacity and yields the maximum flow capacity per inch diameter of pipe. The value of "C" for new Mono-Cast "Enameline" Pipe is 140 or more, and since "Enameline" prevents internal corrosion and tuberculation, this initial high flow capacity is maintained throughout the life of the pipe. Mono-Cast "Enameline" Pipe have internal diameters equal to or greater than nominal diameter and with their maintained high "C" values insure maximum capacity with the minimum sustained pumping costs.

In making recent extensions to its water distribution system with Mono-Cast "Enameline" Cast Iron Pipe and Fittings, Columbus, Georgia enjoyed the distinction of being the first user of "Acipco's" latest contribution to an improved Cast Iron Pipe.

The Permutit Company has been granted exclusive license under the Spaulding patents on his design of Precipitator principally used in cold lime softening of hard water. The city of Springfield, Illinois has a Spaulding Precipitator softening plant for 12 millions of gallons per day and the city of Minneapolis, Minnesota, is now installing a similar Spaulding Precipitator plant for 120 million gallons per day. The Permutit Company is offering this equipment in both municipal and industrial fields.

October

The LOCK JOINT "Book of Experience"

Laying Pipe at Bogota, Colombia

9000 Feet Up in the Andes

THE hazards of towering mountains, precipitous slopes and deep valleys encountered at Bogota, Colombia, were safely and economically surmounted by the Lock Joint Pipe Company in the construction of a 15.8 mile High-Pressure, High-Capacity Concrete Pipe Line.

The citizens of Bogota are permanently assured of an abundant supply of mountain water, because of the enduring qualities built into every length of Lock Joint Reinforced Concrete Pipe.

LOCK JOINT PIPE CO., Ampere, New Jersey
PRESSURE : SUBAQUEOUS : SEWER : CULVERT

LOCK JOINT Reinforced CONCRETE PRESSURE PIPE

AMERICAN WATER WORKS ASSOCIATION

Headquarters Office

22 East 40th St., New York

Officers

President	REEVES NEWSOM Engineer-Consultant, 500 Fifth Avenue New York, N. Y
Treasurer	WILLIAM W. BRUSH
Secretary	HARRY E. JORDAN
Assistant Secretary	P. S. WILSON

Board of Directors

Representing the Local Sections

California Section	NELSON A. ECKART, San Francisco, Cal.	to–1939
Canadian Section	ALBERT E. BERRY, Toronto, Ont.	–1940
Central States Section	H. LLOYD NELSON, Philadelphia, Penna.	–1941
Florida Section	A. P. BLACK, Gainesville, Fla.	–1939
Four States Section	CHARLES H. BECKER, Philadelphia, Pa.	–1939
Illinois Section	HAROLD E. BABBITT, Urbana, Ill.	–1939
Indiana Section	H. A. DILL, Richmond, Ind.	–1940
Kentucky-Tennessee Sect.	E. E. JACOBSON, Lexington, Ky.	–1941
Michigan Section	GEORGE H. FENKELL, Detroit, Mich.	–1941
Minnesota Section	LEONARD N. THOMPSON, St. Paul, Minn.	–1939
Missouri Valley Section	EARLE L. WATERMAN, Iowa City, Iowa	–1941
Montana Section	JOSEPH M. SCHMIT, Lewistown, Mont.	–1939
New England Section	ROGER W. ESTY, Danvers, Mass.	–1941
New Jersey Section	SAMUEL F. NEWKIRK, Elizabeth, N. J.	–1941
New York Section	WILLIAM A. MCCAFFREY, Oswego, N. Y.	–1941
North Carolina Section	PAUL W. FRISK, Enka, N. C.	–1940
Ohio Section	WALLACE W. MOREHOUSE, Dayton, Ohio	–1939
Pacific Northwest Sect.	MILTON H. MCGUIRE, McMinnville, Oregon	–1941
Rocky Mountain Section	CHESTER A. TRUMAN, Colo. Sprgs., Colo.	–1940
Southeastern Section	J. K. MARQUIS, Spartanburg, S. C.	–1940
Southwest Section	JOHN B. WINDER, Dallas, Texas.	–1939
Virginia Section	MARSDEN C. SMITH, Richmond, Va.	–1940
Wisconsin Section	ARTHUR H. MILLER, Sheboygan, Wis.	–1940

Representing the Water Works Manufacturers Association

Manufacturer	DENIS F. O'BRIEN, East Orange, N. J.	–1939
Manufacturer	WILLARD T. CHEVALIER, New York, N. Y.	–1940
Manufacturer	CLINTON INGLEE, New York, N. Y.	–1941

Ex-Officio Members of the Board

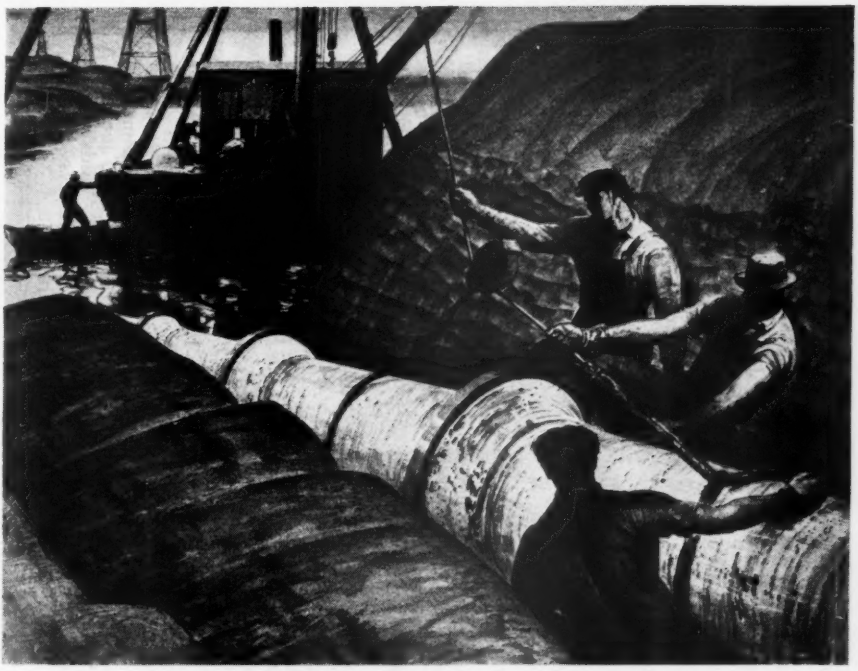
President	REEVES NEWSOM, New York, N. Y.	–1940
Past President	EUGENE F. DUGGER, Newport News, Va.	–1939
Treasurer	WILLIAM W. BRUSH, New York, N. Y.	–1939
Ch. W. W. Practice Comm.	MALCOLM PIRNIE, New York, N. Y.	–1939
Ch. Publication Comm.	LINN H. ENSLOW, New York, N. Y.	–1939

Officers of the Divisions

Finance and Accounting Division.—Chairman, M. F. HOFFMAN; Vice-Chairman, DALE L. MAFFITT; Secretary-Treasurer, WILLIAM J. SCHWARTZ; Directors, JACOB SCHWARTZ, HAL F. SMITH.

Plant Management and Operation Division.—Chairman, THOMAS L. AMISS; Vice-Chairman, A. P. KURANZ; Secretary-Treasurer, D. D. GROSS; Directors, SAMUEL F. NEWKIRK, L. S. VANCE.

Water Purification Division.—Chairman, CHARLES GILMAN HYDE; Vice-Chairman, CHARLES H. SPAULDING; Secretary-Treasurer, CHARLES R. COX; Past Chairman, WILLIAM M. WALLACE; Additional members of Executive Committee, M. C. SMITH, PAUL WEIR.



Lithographed on Stone by James E. Allen for U. S. Pipe & Foundry Co.,
Copyright 1937, U. S. Pipe & Foundry Co.

THE choice of pipe for municipal mains is a major civic responsibility. Not only public health and public safety are involved but the conservation of public funds. Slight saving in first cost may result in large expenditures for maintenance. Records prove that the pipe with the longest useful life and lowest maintenance cost is dependable cast iron pipe, the standard material for underground mains.

UNITED STATES PIPE AND FOUNDRY COMPANY

General Offices: BURLINGTON, NEW JERSEY

Foundries and Sales Offices throughout the United States

U. S. CAST IRON PIPE

Officers of the Sections

Section	Chairman	Vice-Chairman	Secretary-Treasurer	Past-Chairman	Other Members of the Section Governing Board[1]
California	J. E. Phillips	H. Reinhardt	C. M. Hoskinson	R. F. Brown	J. R. Barker, G. W. Hawley, J. S. Longwell, F. S. Porter, C. Wilson.
Canadian	A. B. Manson	—	A. E. Berry	E. V. Buchanan	C. E. Brown, L. G. McNeice, R. J. Smith, G. H. Strickland, F. G. Browne, W. Storrie, W. T. Randall.
Central States	C. H. Young	E. A. Johnson	E. P. Johnson	E. C. Trax	J. Dunwoody, M. Mansfield, A. Martin
Florida	T. M.Lowe	G. F. Catlett	J. R. Hoy	D. S. Wallace	R. G. Ridgely, G. Kingsley, K. R. Chinn, F. R. Mills, W. B. Gibson
Four States	C. J. Lauter	I. M. Glace	C. A. Hechmer	H. M. Freeburn	E. Hopkins, G. Wirtz, R. Beckett, J. DeGroot.
Illinois	W. D. Gerber	F. G. Gordon	C. W. Klassen	F. C. Amsbary	G. B. Prindle, H. H. Gerstein.
Indiana	P. C. Laux	M. H. Schwartz	J. A. Bruhn	J. L. Ford	C. L. Link.
Kentucky-Tenn.	C. M. McCord	H. Arnold	H. D. Schmidt	E. E. Jacobson	H. C. Bristol, H. N. Jernigan.
Michigan	C. R. Bird	R. J. LaMarre	M. N. Gerardy	E. E. Norman	R. Faust, H. Caswell.
Minnesota	J. A. Jensen	E. M. Grime	R. M. Finch	F. Seligman	A. Janzig, C. Elliott, U. Seibert.
Missouri Valley	D. L. Maffitt	B. L. Ulrich	E. L. Waterman	N. T. Veatch	C. Alexander, C. Hoen, E. Mathews, L. Nelson, F. Rathert.
Montana	G. E. Atkinson	C. W. Eyer	H. B. Foote	R. N. Arnold	D. S. Thomas, Kurt Wiel
New England	S. S. Anthony	F. A. Marston	S. M. Ellsworth	W. J. Scott	H. W. Griswold, P. A. Shaw.
New Jersey	W. R. Conard	G. F. Wieghardt	H. N. Lendall	S. F. Newkirk	J. A. Carr, C. H. Capen.
New York	E. L. H. Meyer	F. Henshaw	R. K. Blanchard	A. D. Drake	C. R. Cox, E. K. Wilson.
North Carolina	J. W. Kellogg	R. A. Thomas	A. R. Hollett	H. G. Baity	G. S. Moore, A. O. True, W. E. Vest.
Ohio	W. R. LaDue	W. C. Lawrence	T. R. Lathrop	—	C. Inman, P. Burgess, M. Hoffman.
Pacif. Northwest	N. A. Gilman	T. H. Judd	F. Merryfield	M. H. McGuire	R. E. Koon, M. K. Snyder
Rocky Mountain	L. O. Williams	—	B. V. Howe	O. J. Ripple	B. Coy, J. Soderstrum, K. Darling, R. Streeter, E. Bradner, C. Riddell.
Southeastern	C. P. Townsend	P. Weir	B. P. Rice	D. R. Pringle	F. G. Crow, M. G. Stewart, J. H. McLure, H. F. Wiedeman
Southwest	T. L. Amiss	A. R. Davis	L. A. Quigley	H. E. Nunn	R. W. Harding, L. A. Jackson, A. F. Theard, M. T. Vanlandingham.
Virginia	H. A. Johnson	W. G. Myers	H. W. Snidow[2]	H. B. Rice	E. Meredith,[2] R. Leveque.
Wisconsin	W. U. Gallaher	W. C. Staeffler	L. A. Smith	C. Gruetzmacher	A. E. Hintz.

[1] For Section's representative on the A. W. W. A. Board of Directors, see list on page ii
[2] Virginia Section—Secretary is H. W. Snidow; Treasurer E. C. Meredith

COMING MEETINGS

October 21–22—New Jersey Section, at Berkeley-Carteret Hotel, Asbury Park, N. J. Secretary, H. N. Lendall, Rutgers University, New Brunswick, N. J.

October 26–29—California Section, at Mission Inn, Riverside, Calif. Secretary, Carl M. Hoskinson, Div. of Water, Sacramento, Calif.

October 31–Nov. 2—North Carolina Section, at King Cotton Hotel, Greensboro, N. C. Secretary, A. R. Hollett, Box 281, Chapel Hill, N. C.

December 29—New York Section, at Hotel Pennsylvania, New York, N. Y. Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

April 10–12 (Tentative)—Kentucky-Tennessee Section, at Memphis, Tenn. Secretary, H. D. Schmidt, State Dept. of Health, Nashville, Tenn.

April 12–14—Canadian Section, at Royal York Hotel, Toronto, Ont. Secretary, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

April 27–28 (Tentative)—Ohio Section, at Dayton, Ohio. Secretary, T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

June 11–15—**American Water Works Association Annual Convention, at Atlantic City, N. J.** See page 16 (advertising section) for hotels and rates.

CHANGES IN MEMBERSHIP

New Members, Applications Received August 1 to 30, 1938

BRINKERHOFF, MARVIN J. Secretary, Bogota Water Co., 78 West Main St., Bogota, N. J.

CHIBAS, EDUARDO J. Cons. Engr., Calle H. No. 359, Esquira 17, Vedado, Havana, Cuba.

CITY OF BRISTOL, Tennessee. Mr. R. J. Mottern, Comnr., Dept. of Streets & Public Property, Bristol, Tenn. (Corp. M.)

DUFRESNE, PAUL EDMOND. C.E., Q.L.S., City Engr., P. B. 203, Trois-Rivieres, P.Q., Canada.

FULLER, A. K. District Cashier, California Water & Telephone Co., 971 Orange Ave., Coronado, Calif.

HALL, G. ALBRO. San. Engr. & Supervising Chemist, Floyd G. Browne, Box 134, Marion, Ohio.

HARLOCK, C. R. Junior Officer, U. S. Dept. of Justice, Lock Box 250, Steilacoom, Washington.

HARRINGTON, JOHN B. Associate Engr., State Dept. of Health, Charleston, W. Va.

JENNINGS, FRED HUNTINGTON. Supt. of Filtration, Dept. of Water, 1146 Boyd St., Watertown, N. Y.

KITSON COMPANY. Mr. C. J. Reid, 2409 W. Westmoreland St., Philadelphia, Pa. (Asso. M.)

LATOUR Y OLLIVIER, ASTERIO. Secretaria de Sanidad, Lefe Local de Sanidad de la Habana, Su Lazaro 370 Bajos, Havana, Cuba.

LAVOIE, EDOUARD. City Engr., Chicoutimi, P.Q., Canada.

MACLACHLAN, A. Dist. Sales Representative, (Chapman Valve Mfg. and Simplex Valve & Meter Co.), 1740 East 12th St., Cleveland, Ohio.

MARSHALL, GEORGE A. City Chemist, 355 W. Broadway, Logansport, Ind.

MARTENS, LEROY P. Civil Engr., 715 Central Ave., Wilmette, Ill.

MCDANIEL, B. J. % City Hall, Big Springs, Texas.

MEISSNER, JR., WILLIAM A. Sales Mgr., Farnan Brass Works Co., 1104 Center St., Cleveland, Ohio.

MENCE, HARRY F. Supt., Village of Nyack Water Dept., 134 Main Street, Nyack, N. Y.

MUELLER, H. M. Mgr., Industrial Division, The McKays Co., 473 No. Cleveland Ave., St. Paul, Minn.

OGDEN, JOHN B. Mgr., New Jersey Water Service Co., 3 Paterson Ave., Little Falls, N. J.

SCHMITT, HERBERT C. Construction Engr., Water Dept., 3255 N. 49th St., Milwaukee, Wis.

SHULL, KENNETH EDGAR. Chemist, Philadelphia Suburban Water Co., 2437 Bryn Mawr Ave., Ardmore, Pa. (Junior M.)

SOUTHERN ALKALI CORP. Mr. E. M. Rollins, Jr., Corpus Christi, Texas. (Asso. M.)

Reinstatements

CURRIE, FRANK S. Mgr., Currie Engineering Co., 219 Andreson Bldg., San Bernardino, Calif.

SANDERS, V. G. Civil Engr., Dept. of Water & Power, Box 240 Arcade Annex, Los Angeles, Calif.

Deaths

CRAIG, EARL C. 301 W. 105th St., New York, N. Y.

DISHER, ROBERT J. Northwest Mgr., Pacific States Cast Iron Pipe Co., Spalding Bldg., Portland, Ore.

(Continued on page 34)

(TEAR OFF ON THIS LINE)

Now Ready

THE MANUAL

OF WATER WORKS ACCOUNTING

500 pages of real information

Valuable to Every Water Works Man

Price—for general sales—$4.00

Special Price to A. W. W. A. Members
$3.20—Cash or Check with Order

Mail Your Check and Order Today

(TEAR OFF ON THIS LINE)

AMERICAN WATER WORKS ASSOCIATION:

I enclose check for $..... Please send.....

copies of the Manual of Water Works Accounting to:

_____

PLEASE PRINT NAME

_____

_____

(TEAR OFF ON THIS LINE)

Manual of Water Works Accounting

Prepared Jointly by

The American Water Works Association

and

The Municipal Finance Officers Association

CONTENTS

Chapter 1—Introduction
Chapter 2—Accounting Organization and Control
Chapter 3—The Accounts
Chapter 4—Books of General Entry and Accounting Documents
Chapter 5—Customer Accounting Procedure up to Time of Billing
Chapter 6—Customer Billing and Bookkeeping
Chapter 7—Purchases
Chapter 8—Accounting for Materials and Supplies
Chapter 9—Payroll Accounting
Chapter 10—Accounting for Contractual Services, Interest on Notes, and Taxes
Chapter 11—Depreciation
Chapter 12—Distribution of Clearing Accounts
Chapter 13—Cost Accounting
Chapter 14—Accounting for Cash
Chapter 15—Restricted Funds
Chapter 16—Investments
Chapter 17—Plant Accounting
Chapter 18—Creditor and Ownership Equities
Chapter 19—The Preparation of Financial Statements
Chapter 20—Financial Policies and Financial Planning

USE THE ORDER FORM

ON THE REVERSE OF THIS PAGE

NEWS OF THE FIELD

Water Works men should be interested in the article entitled "Semi-Independent Authorities" in the September, 1938, *Survey Graphic.* Friedrich Blach, its author, has prepared the following résumé.

"Western Europe has passed the stage of economic development of which the TVA controversy is an outer expression in America—the struggle between government and private companies. The oldest European independent authorities, dyke cooperatives, were concerned with flood regulation in the eleventh and twelfth centuries.

"France has no outstanding example of an authority as Americans understand the word. Rather, the government has tended to influence mixed companies. In Germany semi-independent authorities have had a long tradition, for Frederick the Great founded "Landschaften" to assist agriculture by financing farm mortgages. Many German authorities deal with water treatment, irrigation, flood regulation and other purposes connected with water.

"British experience is more pertinent to the American scene. In 1902 the Metropolitan Water Board for London's water supply was founded. Another water authority is the Rand Water Board, Johannesburg, South Africa. In the field of electric power the Central Electricity Board influences all English economics. The creation of a grid system was facilitated by the neutral position of the new authority. It was impossible to amalgamate under private leadership the divergent interests of all the authorized electric supply undertakings, many of them municipal. The Central Electricity Board is assisted by the activity of the electricity commissioners.

"The MacGowan Report recommended that future distribution be planned for the highest efficiency and the condemnation of smaller undertakings if necessary. This would favor private companies if they were the most efficient in the district—an interesting peculiarity, since this right would be also directed against smaller municipal works. On the other hand, the report recommended enactment of ultimate public ownership after fifty years.

"The London Passenger Transport Board took over all transport enterprises, private and municipal. The cooperation of the board and private railroads was carefully considered from the very start. The cooperative bodies outside the board are perhaps too complicated but the principle of the assistance by a neutral factor seems to be sound. The same principle is represented by the influence of the commissioners in the

(*Continued on page 2*)

(*Continued from page 1*)

case of the C.E.B. The transport board is financially facing problems similar to those of the transport undertakings of other large cities. Perhaps the scope of these vast metropolitan enterprises goes beyond the point, important in all public utilities, when concentration becomes too great and begins to damage organic efficiency. A study should be made as to whether a special city planning budget should assume the burden of paying subsidies. The organization of these principle British independent authorities is still in an experimental stage.

"Independent authorities benefit from a balance of influence. Their connections with constitutional bodies, from the supervision of which they are removed, and with the community, toward which they represent governmental power, must be regarded.

"In reviewing various foreign experiences, we find many reasons for independent authorities:

a. Political and social—such as broadcasting; army needs; and social insurance;

b. Public emergency activity if returns do not justify private investments—as for port administration, flood regulation, nagivation, water treatment, rural electrification (also when authorities take over needy private companies which fulfill indispensable tasks);

c. Economic or technical regulations, such as housing and the British grid system.

"Each might possibly involve competition with existing enterprises. Then advantages must be cautiously weighed against disadvantages. The problems of planning for convenience and efficiency are manifold. Their solutions must be made to measure."

John R. Baylis was awarded the Dexter Brackett Memorial Medal at the 1938 annual convention of the New England Water Works Association in Boston. Dr. Baylis, physical chemist in charge of Chicago's experimental filtration plant, receives this award for his outstanding work in water purification. He has worked out the methods which will be employed at the new $21,000,000 filtration plant which is soon to be built to give the south side of Chicago filtered water.

After 35 years with the Lima, Ohio water department, George Kirk, chief engineer, recalls that no engines or boilers remain in the plant now that were there in 1903. All of the water pumping machinery has been replaced. He says men visitors today are chiefly interested in the ponderous Snow cross-compound Corliss pumping engine, while women callers are intrigued with the immaculately waxed and stippled floor.

(*Continued on page 4*)

Nothing takes the place of the

BALANCE

Nothing takes the place of

CAST IRON PIPE

FOR weighing, nothing since biblical days has supplanted the beam balance with two scale pans. For underground mains the standard material today, as for two centuries, is long-lived, economical cast iron pipe.

If you want proved long life and low maintenance cost that result from effective resistance to corrosion —assured safety margins for impact, beam load and crushing stresses—and permanently tight joints—then you will agree that nothing takes the place of cast iron pipe. Some materials meet some of these requirments but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE

The Standard Material Q *for Underground Mains*

(*Continued from page 2*)

Actual work on Chicago's filtration plant has begun with the first steps of building the breakwater in Lake Michigan between 75th and 79th streets. Great Lakes Dredge and Dock Co. has been awarded the contract at $709,825 to build the breakwater which will be of the rubble mound type, 2,660 feet long, shaped like an arrow, and 3,000 feet from the present shore line.

Ohio River Valley Water Sanitation Compact legislation is in process of being formulated. A subcommittee has been authorized to prepare a model bill which will be transmitted to the Governors and Legislatures of the eight states participating in the anti-pollution agreement. A joint meeting of the entire Compact Commission and Incohio (an Ohio Valley Legislative Committee which has been cooperating with the Commission) is considering a few minor changes in the Compact itself. The Compact was adopted four months ago but approval of the Legislatures of eight states remains. These states are: Ohio, New York, Pennsylvania, Tennessee, West Virginia, Kentucky, Indiana, and Illinois.

(*Continued on page 6*)

JOINTING *for* YEARS TO COME

Long after the bill has been paid and forgotten, the main jointed with Tegul-MINERALEAD will be giving trouble-free service • Tegul-MINERALEAD seals quickly, never blows out, stands any pressure the pipe will carry, resists vibration and lasts for years • Less initial leakage, permitting immediate back filling and clearing up of premises • No calking or deep bell holes required. Ingot form—easy to handle and store; impervious to rain and flood • For more information, write

A Tegul PRODUCT

Tegul

MINERALEAD

The ATLAS MINERAL *Products Company of Pennsylvania*
Mertztown . . . . Pennsylvania

IMPORTANT

The Association has run short of certain numbers of the Journal. Any member possessing a copy of any of the following issues which he does not wish to keep should advise this office. We will pay 50¢ each for copies to meet the demands of new members.

May	1930
April	1936
January	1937
February	1937
October	1937
January	1938

IF YOU HAVE A COPY AVAILABLE, JUST DROP US A POST CARD.

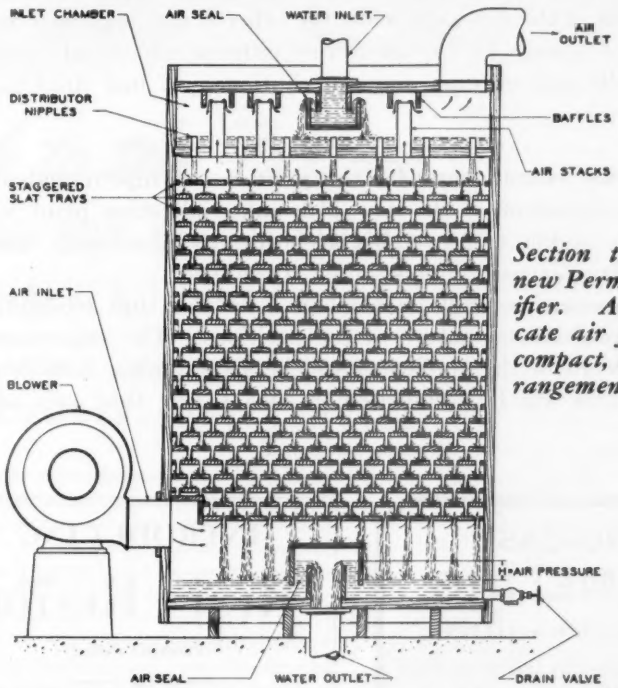
American Water Works Association
22 East 40th St., New York

NEW! PERMUTIT'S DEGASIFIER

(FORCED DRAFT AERATOR)

REMOVES ODORS AND OXIDIZES IRON!

COMPLETELY ENCLOSED MUNICIPAL WATER CONDITIONING UNIT HAS MANY ADVANTAGES



Section through the new Permutit Degasifier. Arrows indicate air flow. Note compact, efficient arrangement.

Permutit, world's largest maker of water conditioning equipment, announces the Degasifier, a more efficient municipal pressure aerator that thoroughly scrubs out and displaces CO_2 and H_2S. It greatly accelerates iron oxidation for subsequent removal by settling and filtration. And it gives efficient, uniform degasification with a minimum of air.

ADVANTAGES: COMPLETELY ENCLOSED. This is important because: (1) Maintains a constant draft system despite weather conditions. (2) Allows installation inside or outside; no danger of splashing or wetting other equipment. (3) Cleans easily by flushing.

UNIFORM DISTRIBUTION OF WATER. Through an air seal at the top, water enters the Degasifier's inlet chamber. This is fitted with specially designed nipples. These nipples distribute the water evenly, prevent change in the inlet chamber's water level—despite wide rate-of-flow variations. Inside the Degasifier proper, water cascades over slat trays, is broken up repeatedly, thoroughly. Water flows out from the bottom through an air seal. Only corrosion-resistant materials are used to insure long, trouble-free life.

Permutit's exhaustive tests with Degasifiers of different types, using varying flow rates and CO_2 content, make it possible for them to provide you with a Degasifier which will give optimum degasification with a minimum of space and air requirement.

WRITE TODAY for free bulletin describing in detail this new Permutit product. The Permutit Company, Dept. G 2, 330 W. 42nd St., N. Y.

PERMUTIT

World's Water Conditioning Headquarters

OVER 25 YEARS

(*Continued from page 4*)

No water in the faucets is the situation in Somerset, Ohio. Saddest part of the situation is that there is no water in the wells of the three-year old system built with Federal aid. After a few futile shakings and twistings of the faucets, the consumers fell back upon old wells and cisterns while two drilling companies began efforts to find a supply. One driller is deepening one of the dry wells while the other is starting a new well on another side of town. In the meantime citizens rehabilitate partially abandoned wells and cisterns and are cautioned to boil drinking and cooking water.

Civil service examinations for the positions of superintendent and assistant superintendent of the new Milwaukee filtration plant will be held about the middle of November according to information from the office of the City Service Commission of Milwaukee.

These examinations will be conducted so that full recognition is given to the professional nature of the positions. The experience and professional record of the applicants will be given proper consideration. The examinations will be formulated in such a way that men of high

(*Continued on page 8*)

MONO-CAST
ENAMELINE
CAST IRON PIPE & FITTINGS

Pipe manufactured by the Mono-Cast Centrifugal Method in sand-lined refractory molds

"ENAMELINE" is the trade name for a 3-coat lining applied to the interior surface of Mono-Cast Centrifugal Pipe and Acipco Cast Iron Fittings. The first two coats consist of a special mortar made up of Portland cement mixed with clean silica sand, and the third coat is an asphalt paint. It is offered as an alternate for standard tar coating—at no extra cost—and is recommended for water main service throughout the United States except in very special cases where additional thickness of lining is desirable.

AMERICAN CAST IRON PIPE COMPANY Birmingham, Ala.

New York City Chicago Kansas City Minneapolis Dallas
Los Angeles San Francisco Pittsburgh Cleveland

INTRODUCING
RUSTA RESTOR Trade Mark
(Patents Pending)

An electrical appliance which eliminates Rusting, Corrosion, Pitting and Painting below the water line in water tanks.

Costs about as much as a coat of paint to own, and less than 50¢ a month to operate.

Full particulars on request. Write
RUSTA RESTOR CORPORATION
FREMONT, OHIO

Look to the Future

WHEN YOU BUY WATER WORKS VALVES TODAY

CRANE AWWA VALVES ASSURE LONG TROUBLE-FREE SERVICE

Your water system makes your city livable . . . brings health and comfort to your people . . . is the life-source of your industry. It's the true foundation of *your* city's future. Consider this when you buy water works equipment. Choose valves that you know will serve today's needs . . . meet tomorrow's emergencies.

Crane No. 480½ AWWA Valves are built to give that kind of performance. Crane double-disc gate valve construction is scientifically designed to provide positive action—tight and true . . . to make every part function smoothly and efficiently throughout a long life of dependable operation.

Backed by Crane's unmatched skill in valve engineering and metallurgy . . . Crane's unparalleled manufacturing experience of more than 80 years, these valves possess an inherent stamina that accounts for their uncommon behavior . . . unusual economy . . . enduring service. They're proving it daily in water systems of every size—throughout the country.

You can avoid many future problems of flow-control on the mains by installing Crane AWWA valves now. Ask your Crane representative to demonstrate their superior features—as well as other Crane-Quality equipment of *uncommon* quality—for your water works, filtration plant and sewage system.

Crane No. 480½ AWWA Double-Disc Gate Valve with hub ends. Made in sizes of 2" to 48".

IT'S WHAT'S INSIDE THAT COUNTS!

CRANE VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVENUE, CHICAGO

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

(*Continued from page 6*)

qualifications can afford to enter them without feeling that they are injuring their professional standings. The names and ratings of applicants will not be made public by the City Service Commission.

Applicants must be U. S. citizens, though local residence qualifications are waived for these examinations. Herbert W. Cornell, Chief Examiner and Secretary of the Commission, says that it is his intention to arrange the examinations in such a way that it will not be necessary for applicants to come to Milwaukee though, perhaps, those at the very head of the list may be summoned for oral interview before final selection is made. These details, however, are as yet only tentative.

Salaries for these two positions are set by the Milwaukee Common Council on a sliding scale basis, superintendent going automatically from $3,600 to $4,500 per year and assistant superintendent from $2,700 to $3,420 per year. These salaries are exempt from federal income tax. A small deduction is made under Milwaukee's pension system which is reputedly a good one.

Full details of the examinations will be sent to prospective applicants writing Herbert W. Cornell, City Service Commission, Milwaukee, Wis.

(*Continued on page 10*)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

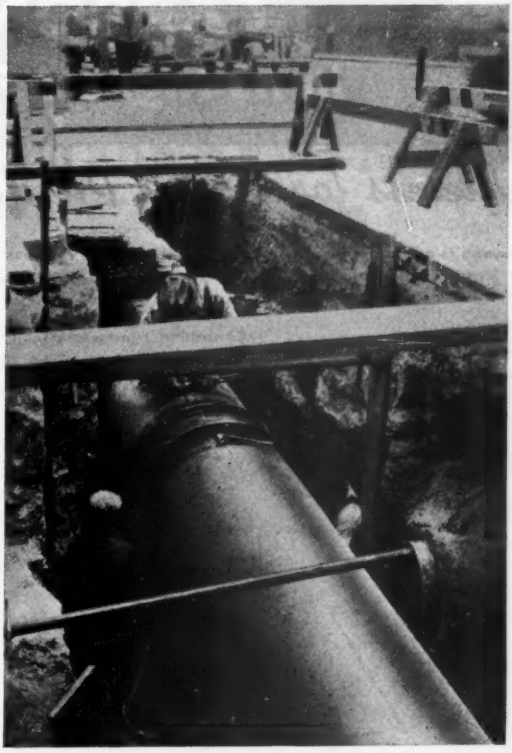
Hand Operated—size 2″, 2½″, 3″, 4″
Power Operated—size 3″ and 4″
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

THE ANSWER TO A PROBLEM

ALCO PIPE FOR CHICAGO



Cities using ALCO STEEL PIPE include the following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W Va
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y
New Brunswick, N.J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

The Water Department of Chicago and the Chicago Union Station were jointly and seriously concerned about the material to use in the 36" line to replace pipe running under the tracks of the station. The answer, illustrated above, is Alco Electric Welded Steel Pipe. No further need to worry about disastrous breaks.

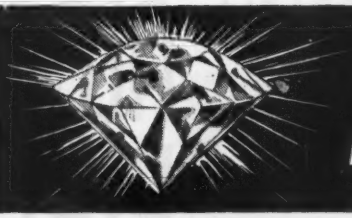
ALCO FEATURES

Greater Strength
Longer Life
Smoother Waterway
Longer Lengths
Fewer Field Joints
Low Initial Cost
Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS DIVISION
30 Church Street New York, N. Y.
CHICAGO WASHINGTON PITTSBURGH HOUSTON TULSA
Plants at Dunkirk, N. Y., and Montreal, Canada Cable Address: Alproducts.

AMERICAN LOCOMOTIVE COMPANY



CARBON
In Its Highest Form

But Valueless for Water Purification

Although the diamond is carbon in its most valuable form, it is worthless compared to CLIFFCHAR ACTIVATED CARBON for water purification.

Leading municipalities place high value on CLIFFCHAR to remove objectionable taste and odors from water supply.

CLIFFCHAR "R"
Special Grade for Water Purification

Low phenol value, shown by standard phenol tests, gives high ability to remove phenolic and similar compounds.

Extreme fineness (99% passing a 325 mesh screen) gives maximum surface exposure and adsorptive capacity.

Controlled, uniform density assures sufficient suspension period to take full advantage of its high adsorptive ability, yet settle out in ordinary settling basins.

The technical and laboratory facilities of this company are available without obligation to those concerned with taste and odor problems in water purification. Your inquiry is invited.

Cliffs Dow

REG. U. S. PAT. OFF.

CLIFFS DOW CHEMICAL COMPANY, Marquette, Michigan

Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Sts., St. Louis; Field Bldg., Chicago

(*Continued from page 8*)

Albert S. Hibbs, Superintendent of the Cincinnati water works, resigned September 1, and Carl A. Eberling has been appointed to the position. Mr. Eberling started with the water works as a draftsman in 1911. In 1918 he was promoted to principal assistant engineer. Promotion continued for him until in 1930 he was made assistant superintendent in charge of distribution, in which position he continued until his advancement to the superintendency.

War on Rattlers. It's not snakes the water department of Jackson, Mich. is after; it's the rattle in the man hole covers. Everett D. Cattell, superintendent of water distribution, has set repair crews to inspecting the man hole covers and attempting to fit them more closely. Mr. Cattell says the work is being done because a number of persons have complained about the noise made by autos passing over the covers.

W. R. LaDue, chief engineer, and acting superintendent of water works, Akron, Ohio, has been named the first chairman of the newly created Ohio Section of the A.W.W.A.

(*Continued on page 12*)

3 out of 4 PIPE DOLLARS

BUY IRON AND STEEL PIPE

It's a fact! Three-fourths of all American money invested annually in pipe goes for rolled iron and steel pipe. This acceptance is a good indication that no other type performs as efficiently per dollar of cost, or per year of service.

You'll find these advantages especially evident in Armco Spiral Welded Pipe. Available in wall thicknesses up to ½-inch, this improved butt-welded pipe assures abundant strength, high flow capacity and freedom from costly leakage. You also have your choice of various joints, coatings and standard or special fittings.

Plan now to reduce your water transportation costs with Armco Spiral Welded Pipe. Just address your inquiry to The American Rolling Mill Company, Pipe Sales Division, 1741 Curtis Street, Middletown, Ohio.

ARMCO

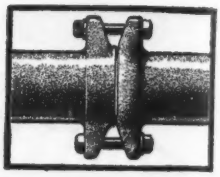
ARMCO

SPIRAL WELDED PIPE

APPROVED BY UNDERWRITERS LABORATORIES, INC.

UNIVERSAL CAST IRON PIPE

LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

THE CENTRAL FOUNDRY COMPANY

General Offices: 386 FOURTH AVENUE, NEW YORK

CHICAGO, ILL., 1105 W. 36th St. - OAKLAND, CALIF., 278 Fourth St.

OFFICES IN PRINCIPAL CITIES COAST TO COAST

(*Continued from page 10*)

Water revenues have been washed away with the abnormally heavy rainfall in many parts of the country this summer. Henry C. Bohmann gives the specific example of Milwaukee, Wis., where he is superintendent of the water department. His prediction is a falling off of about $144,000 in 1938 from the revenue figure for 1937. He says the abnormal rainfall reduced the pumpage about 2,000,000,000 gallons, for the summer pumpage, usually very high due to lawn sprinkling, fell off markedly on all but a very few hot days.

The layman learns about algae: The Sparta, Ill. News Plain-dealer tells the reader "Algae is back!" "He makes his appearance each year about mid-September in the city reservoir and seems to be badly afflicted with BO. As a result, the water flowing through the city mains has a disagreeable taste and odor. There is nothing alarming about this situation as "Algae" is as harmless as his name indicates. Decaying vegetation in the reservoir permeates the water but all impurities are removed in the treatment plant. Only the taste remains."

(*Continued on page 15*)

FIRST QUALITY METERS EXCLUSIVELY

SPECIFY *American* or *Niagara*

(BRONZE CASE) (IRON CASE)

Water Meters

WRITE FOR CATALOG

BUFFALO METER COMPANY

Established 1892 2914 Main St., Buffalo, N. Y.

(*Continued from page 12*)

"Saturday night is still bath night" is the subject of an Associated Press dispatch from Louisville, Ky.

"As many people still take baths on Saturday nights as formerly, according to George C. Keller, supervisor of the Louisville Water Company's reservoir. 'Try as I do,' says Hill, 'I still can't keep the water level up on Saturday night, and I know it's just people taking baths. It usually starts getting lower about 8 o'clock, and by 10 or 11 o'clock the gage shows two or three feet less water. And when you stop to think that each foot of water means almost a million and a half gallons of water, that means that plenty of people are taking those baths.'"

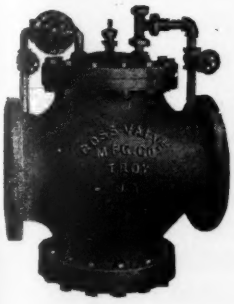
Perhaps the public relations departments of water works should come to the rescue of the distribution departments and popularize an off-peak rate for bath water.

"Bill the tenant, not the property owner," says City Solicitor John D. Pincura of Lorain, Ohio. Mr. Pincura believes that charging water bills to tenants would save the water works large amounts of money each year. An Ohio Supreme Court decision of 1934 states that the bills cannot become

(*Continued on page 16*)

THE STANDARD
for more than
50 YEARS

WATER WORKS SPECIALTIES



Automatic Pressure Control Valves

Pressure Reducing-Altitude

Surge-Relief and Combination Valves

Portable Fire Hydrants

Hydraulic Booster Pumps

ROSS VALVE MFG. CO., INC. TROY, N. Y.

(*Continued from page 15*)

liens on the property, and so the city has no way to collect when tenants owing bills move out. Many Ohio cities, since the Supreme Court decision of 1934, have adopted the system of billing the tenant and requiring a small deposit from him. This system appears to have some advantages over the system of merely billing "Mr. Property Owner, 1001 One St." If the property owner rents his house to a tenant, this tenant may find the bill in his mail box and discard it. Thus, the owner may never be notified that he owes a bill.

Water Works Cashier T. W. Morgan believes the present system of billing the property owner better because, as he says, the health department of Ohio holds owners responsible for sanitary devices. Morgan says, "If property owners are afraid that tenants will move out leaving large water bills for them to pay, let them require their own deposits." Morgan says the tenant cannot be sued in case of a delinquent water account, while the property owner can. But Pincura says that it is impractical to go to court to get a judgment on a $3 water bill because court costs of the action would amount to much more than the amount sued for.—Lorain, Ohio, *Journal.*

(*Continued on page 18*)

American Water Works Association 59th Annual Convention

Atlantic City **June 11–15, 1939**

Housing Headquarters **Ambassador and Chelsea Hotels**

MAKE YOUR RESERVATIONS NOW

Single rooms	20	at	$2.50*
	75	at	3.00
	30	at	4.00
	60	at	5.00
	10	at	6.00
Double rooms	10	at	4.00*
	40	at	5.00
	260	at	6.00
	240	at	7.00
	115	at	8.00
	25	at	10.00
Suites	80	at	12.00–20.00

* Lowest priced rooms are without bath.

SAVING POWER *in* PUMPING SOLIDS IN SUSPENSION

CAREFUL stream-lining of impeller and casing has been applied in the

DE LAVAL CLOGLESS PUMP

not only to insure large, open and direct passages which offer no corners or obstructions to cause clogging, but also to obtain efficiencies which compare very favorably with those of standard high speed clear water pumps. Efficiency is further promoted and its continual maintenance insured by the use of renewable combined sealing and wearing rings of bronze, one threaded on the impeller and the other seated in the casing and casing cover. Sealing with clear pressure water prevents abrasive matter from entering between the rings, and a similar seal keeps abrasive matter away from the stuffing box and the impeller hub protecting sleeve.

The horizontally split pump casing permits quick inspection or renewal of internal parts without disconnecting suction or discharge piping.

Ask for Catalog B-1.

De Laval Clogless Pumps driven by directly connected Diesel engines.

DE LAVAL STEAM TURBINE CO.

TRENTON, NEW JERSEY

(*Continued from page 16*)

Water rates are reduced at Highland Park, Mich. upon the recommendation of George J. Golden, superintendent of water works. New rates are from 15 to 20 per cent less than the old and the new rates are retroactive to July 1. Mr. Golden says the cut in rates was made possible by a reduction of the debt of the water department.

A reduction in water rates, amounting to 75 per cent on minimum bills, has become effective in Geneva, Ohio. This drastic reduction in water rates is but a mixed blessing for it comes simultaneously with the imposition of sewer rentals.

Michigan cities are busy at work on new water works, extensions, softening plants, stand pipes and improvements, taking advantage of federal funds in the current recovery program. Perhaps the largest project in Michigan is the $4,100,000 water supply system at Grand Rapids, a P.W.A. grant for part of which has already been approved.

Muskegon Heights has plans for an intake at a cost of about $160,000 and the city also is making a W.P.A. application for $980,000 to build a

(*Continued on page 20*)

Modern Fire Protection

demands

SAFETOP FIRE HYDRANTS

ARE you planning any water service extensions in your community? If so, be sure to specify Kennedy SAFETOP Fire Hydrants—to provide maximum protection to the neighborhood, with minimum maintenance expense to your department. Kennedy SAFETOP Fire Hydrants meet modern fire service requirements, modern traffic conditions, and modern standards of practical design combined with attractive appearance.

Write for full information

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY
SAFETOP
FIRE HYDRANT

A THREE-WAY CUT IN WATER-CARRYING COSTS!

1. Saves on Installation

Transite Pipe is light. Every handling represents a saving. And Transite's Simplex Couplings, requiring no caulking, are rapidly and economically assembled by unskilled labor.

Result—profitable savings in time and money that lower installation costs!

2. Saves on Maintenance

Transite Pipe, because of its asbestos-cement composition, provides your best assurance of permanence. It is immune to electrolysis and tuberculation, highly resistant to soil corrosion.

Result—no cleaning expense, and a pipe that virtually eliminates costly shutdowns and renewals.

3. Saves on Pumping Costs

Because it cannot tuberculate under any circumstances, Transite Pipe maintains its initial high delivery capacity indefinitely. Its initial flow coefficient, conservatively estimated at C-140, remains at that figure throughout Transite's long years of service.

Result—pumping costs on Transite lines stay permanently low!

Hence Transite Pressure Pipe effects the three-way cut in water-carrying costs that promises you a permanently economical pipe line. Send for our free, illustrated brochure. It will tell you all you want to know about the advantages Transite offers to water transportation. Write to Johns-Manville, 22 East 40th Street, New York City, for your copy.

Johns-Manville
TRANSITE PRESSURE PIPE
An ASBESTOS Product

JM

(*Continued from page 18*)

filtration plant and a pipeline from Lake Michigan to the city. Ypsilanti has let a contract for a $117,698 purification plant. Two new standpipes to replace old ones will be erected at Kalamazoo. Erection of these standpipes at a cost of $206,000 will mark the culmination of a long-range program which has greatly improved water distribution in Kalamazoo. Surveys have been made for a half-million dollar softening plant but Kalamazoo has not as yet put the project through.

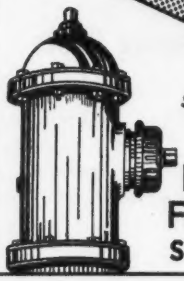
Battle Creek is drilling five new wells at its Verona pumping station, laying new mains near the station, and generally improving and repairing the system. This work is the first step in a recommended million-dollar water works improvement program. Davison, Mich., is constructing with P.W.A. help a well, a pumping station, an elevated tank, a distribution system and a purification plant. East Lansing has planned building a $100,000 treatment plant contingent upon issuance of $70,000 in bonds.

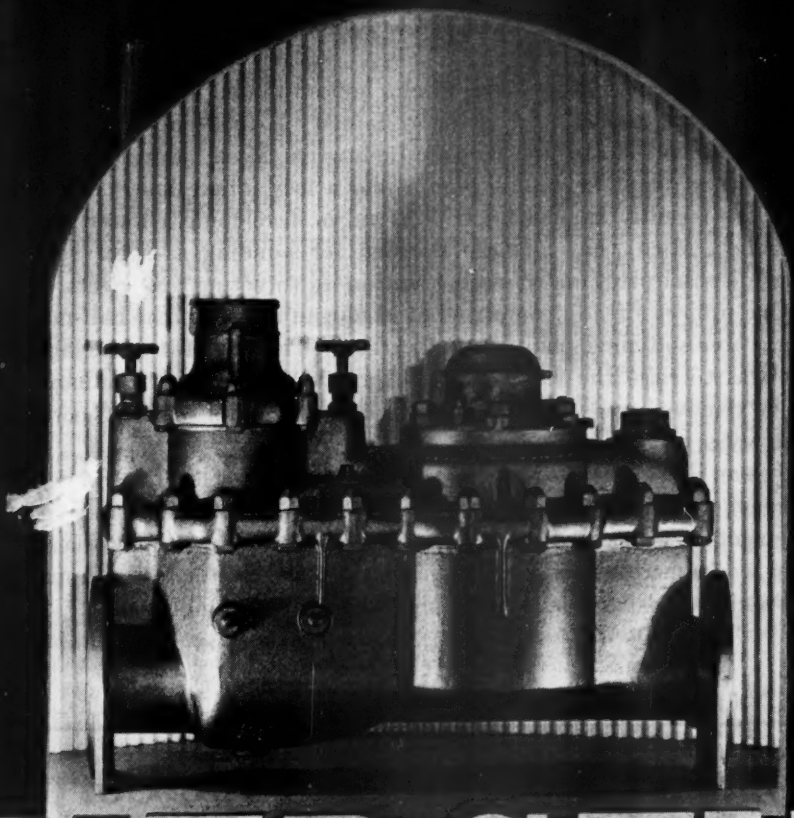
Other work under way or planned is a water works system at Bridgeport, Mich., and a new water works system at Frankenmuth, Mich., where the largest vote in the town's history, 251 to 80, approved building

(*Continued on page 22*)

The Ford Resetter
AN IDEAL FITTING for RAISING TOO-LOW METERS EASILY
Connects between old meter couplings.
Durable,—all brass and copper.

Improve your old meter settings by installing the RESETTER. Bring your water meters up out of the mud and water so that they are easier to read and take care of. Write for catalog.
The Ford Meter Box Co.
WABASH, INDIANA

50 years of Production Experience back of KUPFERLE FIRE HYDRANTS

SEND FOR SPECIFICATION SHEETS
John C. KUPFERLE Foundry Co.
ST. LOUIS, MO.



HERSEY

For capacity and Accurate Registration of all rates of flow, the Hersey Compound Meter outmatches any single unit or battery of meters. Self-contained bronze case up to 6 in.

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
SAN FRANCISCO — LOS ANGELES

(*Continued from page 20*)

the $90,000 system. Rockwood, Mich., hopes to build its $47,000 system in three months time to have water by January 1, 1939—according to the Village President J. Harvey Wood. Ludington, Mich., plans virtually a complete new plant, including pumps and a new intake line. Milwood, Mich., has recently applied for P.W.A. aid in developing a water supply. Watervliet, Mich., has put the decision for building a water system, sewage disposal plant and pumping station up to voting tax-payers.

One project already completed in Michigan is that of the half-million dollar water softening plant at Ann Arbor. The plan for financing this plant was to raise the water rates. About 80 per cent of the hardness is to be removed so as to effect an estimated saving of $150,000 per year to the water consumers.

It's an ill wind that blows no good, and no matter how the depression and relief may be viewed, there is still the good of construction and improvements in water works that might not have been carried out otherwise. Water works men, who are using their heads, are effecting every improvement and vital expansion possible under the present conditions.

(*Continued on page 26*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2″ to 84″

Flanged Pipe *Flexible Joint Pipe*

Bell and Spigot Pipe

Special Castings *Short Body B. & S. Specials*

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

MORRIS KNOWLES, INC.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.
Pittsburgh, Pa.

ALEXANDER POTTER
Consulting Engineer
Specialties: Water Supply and Sewerage
50 Church St. New York City
Telephone 5501 Cortlandt

METCALF & EDDY
Engineers
Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories Valuations
Boston, Mass. **Harrisburg, Pa.**
Statler Building **Telegraph Building**

CLYDE POTTS
M. Am. Soc. C. E.
Consulting Sanitary Engineer
30 Church Street - - New York
Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

REEVES NEWSOM
Engineer - Consultant
Supply, Purification and Distribution of Water
Operation Design Construction
Valuation Rates Negotiations
Investigations Taxes Accounting
500 Fifth Avenue New York City

SCOFIELD ENGINEERING CO.
Consulting Engineers
Water, Gas, Electric Plants and Distribution Systems
Appraisals, Valuations and Reports
Design—Supervision—Operation
Philadelphia, Penna.

PEASE LABORATORIES, INC.
39 West 38th Street, New York
Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.
Chemists Field Sanitary Surveys
Bacteriologists Consultants

WESTON & SAMPSON
Robert Spurr Weston **G. A. Sampson**
Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.
14 Beacon St. Boston, Mass.

MALCOLM PIRNIE
Engineer
Water Supply, Treatment, Sewerage,
Reports, Plans, Estimates,
Supervision and Operation
Valuation and Rates.
25 W. 43rd St., New York, N. Y.

WHITMAN, REQUARDT AND SMITH, *Engineers*
EZRA B. WHITMAN NORMAN D. KENNEY
GUSTAV J. REQUARDT ROBERT T. REGESTER
BENJAMIN L. SMITH THEODORE W. HACKER
WATER WORKS - SEWERAGE - UTILITIES
Baltimore, Md. Albany, N. Y.

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings
50 Church St. New York City

Help Build up Your Association by Bringing in a New Member
SEND FOR APPLICATION BLANK
AMERICAN WATER WORKS ASSOCIATION
22 East 40th St. NEW YORK CITY

(*Continued from page 22*)

The new Wright Brothers Wind Tunnel is the first pressure wind tunnel in the United States, and was formally dedicated on the campus of Massachusetts Institute of Technology, September 12, with ceremonies attended by Orville Wright and other prominent aeronautical engineers. Built by Pittsburgh-DesMoines Steel Company, Pittsburgh, Pa., builders of municipal water works, tanks, and towers, the tunnel is of interest to water works engineers because the design and construction of the unit involved problems and methods identical with those occurring during the construction of water works equipment. The welded steel tunnel is really a pressure vessel designed to operate with pressures varying from $\frac{1}{4}$ to 4 atmospheres absolute, and was constructed under the rules of the American Society of Mechanical Engineers Codes for Unfired Pressure Vessels.

Upon completion the tunnel was subjected to a hydrostatic test up to 54 pounds gauge pressure which was 25 per cent in excess of the maximum working pressure, and was found to be absolutely free of leaks in the welded seams or joints. This test also served to stress relieve partially the secondary stresses around the corners and the shrinkage stresses caused by welding. Design of the corner girders is similar to the design

(*Continued on page 28*)

LUDLOW
HYDRANTS
always work!

Special design and construction protect Ludlow Hydrants from sub-zero temperatures. Water is drained off from the bottom—cannot freeze in the barrel. This means a big saving in maintenance, eliminating need for digging and replacing. These hydrants always save on water, the valves being perfectly seated to prevent leakage and undue wear.

Send for the complete Ludlow catalog of standard and special purpose hydrants, sluice gates, and valves of all types.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

It makes NO difference to

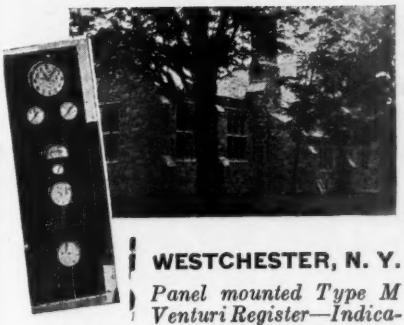
% PROPOSITIONEERS %

"Perchloron"
"HTH"
"Columbia"
"Wil-Chlor"
"Maxochlor"
"Purex"
"Chlorofectant"
"Chlorox"
"Isco"
"Kohnstamm"
"Clor-O-Mor"

Accurately fed by Chlor-O-Feeders, these chemicals have all been proved practical in chlorinating medium and small water and sewage plants; and even to sterilize big plants in emergencies.

% PROPORTIONEERS, Inc. %
18 Codding St., Providence, R.I.

FLOW AND LEVEL METERS FOR THE COMMUNITY PLANT



WESTCHESTER, N. Y.

Panel mounted Type M Venturi Register—Indicator—Recorder at Rye Lake Pumping Station.

NEW ROCHELLE, N. Y.

Chronoflo Transmitters in the Metz Reservoir Gate House transmit water level to distant Chronoflo Recorders. Venturi Meter measures flow.

Experienced engineers and superintendents of small, large, and medium size plants choose Builders Venturi and Chronoflo Meters and Controllers to aid in maintaining initial efficiency and in keeping down cost of operation.

Bulletin 298 shows many new applications of Chronoflo Meters. Would you like it?

BUILDERS IRON FOUNDRY
"Builders of the Venturi Since 1887"
9 Codding St. Providence, R. I.

LIQUID CHLORINE
"The Great Purifier"

AT the turn of the century, when Chlorine was first introduced as a water purifier, there ensued a widely publicized lawsuit to prevent its use. Curiously enough, instead of preventing its use, the facts of the case so clearly demonstrated Chlorine's value for purifying water that all doubt was forever allayed in the public mind.

Today, over 75% of the drinking water of America is chlorinated and the typhoid rate is the lowest in history. "The great purifier" has done its job well. Its merits require no further selling.

But the test of a service is its availability in times of emergency. Solvay's new "Big 3" Liquid Chlorine Service is designed to fulfill that test. Modern plants, the latest production equipment, a well equipped Technical Service assure State and Municipal authorities of quick and adequate supplies of Solvay's Liquid Chlorine and good advice and technical assistance when required.

Solvay Liquid Chlorine shipments are now routed from Syracuse, New York; Hopewell, Virginia; and Baton Rouge, Louisiana. Your inquiries on Solvay Liquid Chlorine are cordially solicited. Please write to

SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 RECTOR STREET NEW YORK, N. Y.

SOLVAY
LIQUID CHLORINE

(*Continued from page 26*)

of reinforcement for penstock wyes, tees, and elbows, although the problem was further complicated by the presence of air stream direction vanes welded to the inside flanges of the girders. However the elastic balance, between the stiffening effect of the girders and the stretch or shrinkage of the vanes, was successfully calculated and strain gauge measurements proved that none of the actual stresses in the structure varied from the calculated stresses by more than 7.5 per cent.

A steadily falling ground water level has brought about action in Hamilton and Butler counties, Ohio, by the Millcreek Valley Conservation Association. This locality has the two industrial centers of Hamilton and Middleton, and many companies, which draw water from underground, assert that the lowering of the water table has been so rapid in the last few years that a shortage seems imminent. Shortage of water would particularly work hardship upon the steel and paper industries in this region. E. O. Meinzer, chief of the U. S. Geological Survey journeyed from Washington, D. C. to speak to the Millcreek Valley Conservation Association and explained the methods used in the survey of the valley

(*Continued on page 30*)

CLEAN YOUR WATER MAINS

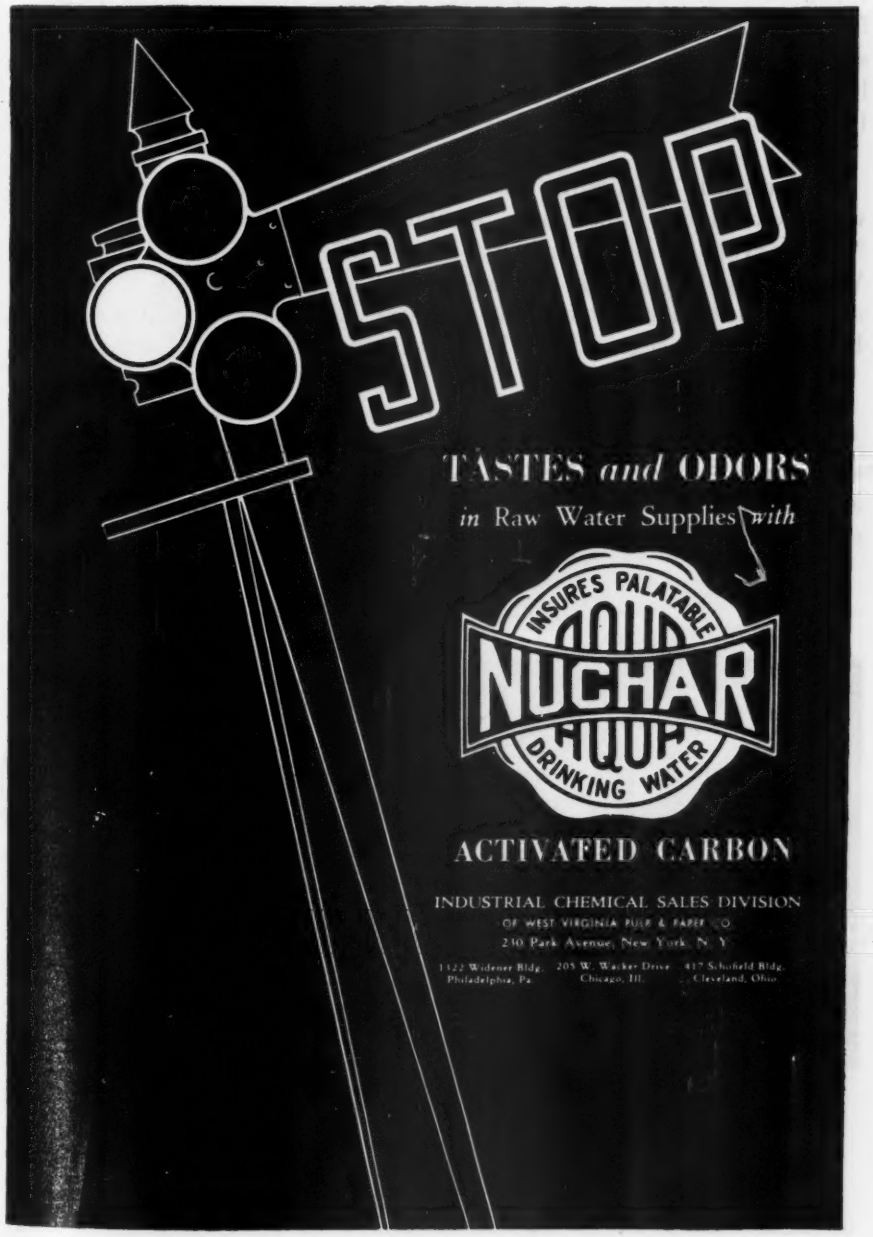
One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

50 Church St., New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.


STOP
TASTES and ODORS
in Raw Water Supplies with
INSURES PALATABLE
NUCHAR
DRINKING WATER
ACTIVATED CARBON
INDUSTRIAL CHEMICAL SALES DIVISION
OF WEST VIRGINIA PULP & PAPER CO.
230 Park Avenue, New York, N. Y.
1122 Widener Bldg. Philadelphia, Pa.
205 W. Wacker Drive Chicago, Ill.
417 Schofield Bldg. Cleveland, Ohio

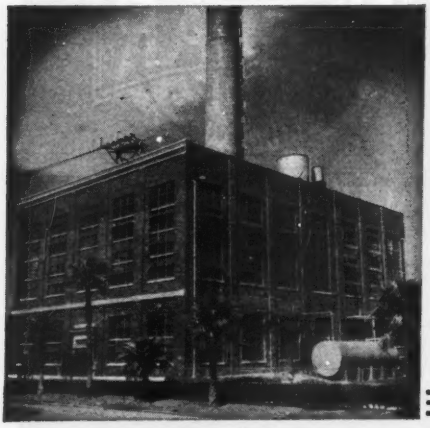
(*Continued from page 28*)

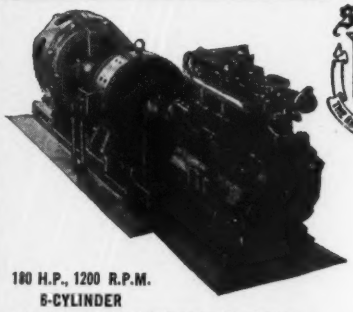
which was begun June 1. Wells sunk to a depth of 20 feet in this locality formerly gave a satisfactory yield but now such wells are dry and wells sunk to 30 and 40 feet are not producing satisfactorily. One suggestion has been made that stored water be used for industry and thereby lessen the demand upon the ground water resources.

Maurice B. Rudderow, Manager of the Merchantville, N. J., water works, died late in September. For many years he was President of the Merchantville Water Company (later the Merchantville-Pennsauken Water Commission). He became a member of the A.W.W.A. in 1914 and was one of those active in the organization of the Four States Section. He was widely recognized as a highly efficient water works administrator.

James C. Rowe, one of the promising young members of the A.W.W.A., died September 15 after a long illness. He was an operator at the Saratoga Springs, N. Y., filter plant and was becoming recognized as an efficient water purification man. It is greatly to be regretted that so capable a person was not permitted a longer life of useful service.

(*Continued on page 32*)





180 H.P., 1200 R.P.M.
6-CYLINDER
ENGINE PROVIDES EMERGENCY POWER

Sterling

THE SYMBOL OF RELIABILITY

HOUSE SERVICE STANDBY PLANT

Florida Power Corporation's Bayboro Plant, located at south end of system, dispenses with standby steam boiler—eliminates maintenance of 50 lb. steam pressure—keeps boilers warm with out-side steam. The Sterling Engine supplies motive power for the house service generator, for bringing one boiler and the plant on the line. Result: Important Savings!

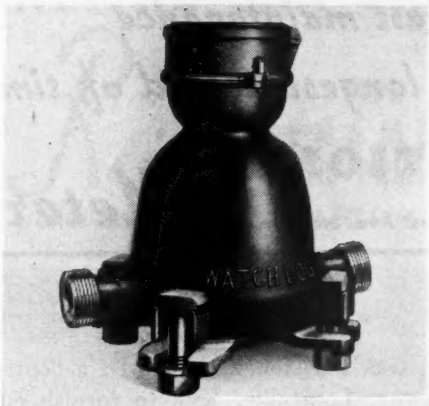
STERLING ENGINE COMPANY

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

Dept. C-3

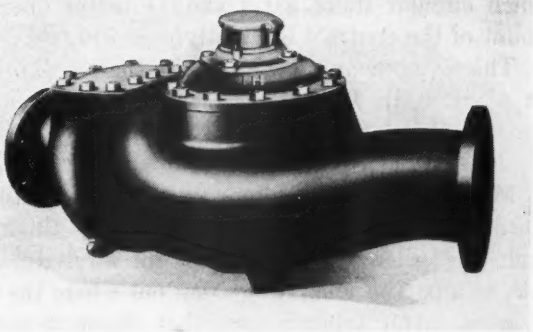
Branch Office
900 Chrysler Bldg.
New York, N. Y.

WATCH DOG METERS



Turbine meter

Frost-proof meter



Investigate these meters

. . . more than 3,500,000 now in use

WHEN looking over your requirements, remember that thousands of municipalities are getting satisfactory low-cost service from Worthington-Gamon Meters.

WORTHINGTON-GAMON METER COMPANY

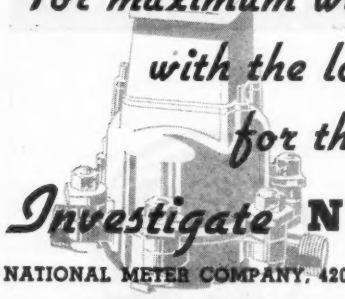
General Offices: HARRISON, NEW JERSEY

Offices and Representatives in Principal Cities

WORTHINGTON-GAMON

WGS-7

For maximum water revenue
with the lowest maintenance
for the longest period of time



Investigate **NATIONAL** *Meters*

NATIONAL METER COMPANY, 4207 First Ave., Brooklyn, N. Y.

(*Continued from page 30*)

Koppers Company's Western Gas Division has received a contract from the Louisville Water Company, Louisville, Ky., to furnish eight 48-inch circular sluice gates and 11 motor operated floor stands. The amount of the contract is slightly over $10,000.

This equipment will be used in the rehabilitation of the city's filtration plant. Mr. L. S. Vance, chief engineer and superintendent of the Louisville Water Company, will supervise its installation at the city plant.

Metering of flush tanks is up for consideration in Ann Arbor, Mich., according to the Ann Arbor News. City Engineer George H. Sandenburgh was ordered to investigate the advisability of metering the flush tanks as a part of a survey to find out where the un-metered water of the city goes. Ann Arbor reports that about 25 per cent of the water now pumped into the mains does not pass through metered lines and it is to check the amount of water used by flush tanks that the survey is being considered. There are between 300 and 400 flush tanks which will be metered if the Ann Arbor water department and the Board of Public Works jointly approve the survey.

(*Continued on page 34*)

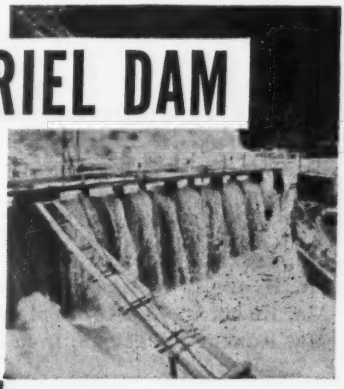
ATTENTION

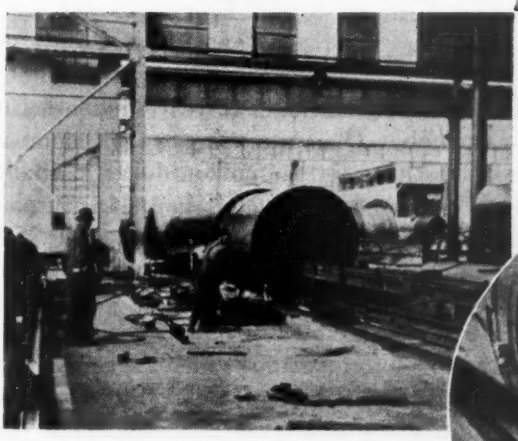
We will pay $1.00 for a copy of the June, 1926 Journal. *Do not* send it in—just let us have a postal card, advising that it is available.

AMERICAN WATER WORKS ASSOCIATION
22 East 40 St., New York, N. Y.

☆ AT THE SAN GABRIEL DAM

Reilly PIPE ENAMEL AND PRIMER provides permanent protection for Conduits

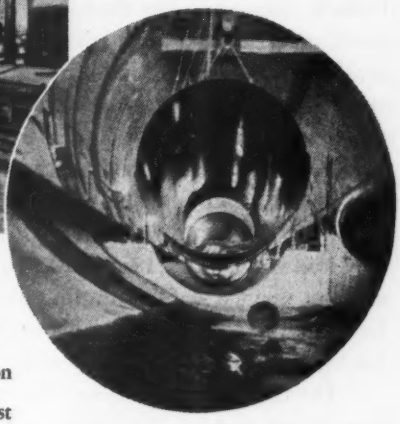




• Above: *Photograph of Dam, showing discharge through 51" venturi tubes.*

• Left: *Application of Reilly Pipe Enamel.*

• Below: *Installing 96" x 40' steel tubes after coating with Reilly Enamel and Primer.*



IN MAJOR construction projects, such as the San Gabriel Dam, pictured here, Reilly Pipe Enamel and Primer is relied upon for protection of pipe lines and conduits against rust, corrosion, tuberculation, and other destructive agents. Reilly Enamel provides a coating that is resistant to abrasion, withstands high temperatures approaching 200° F. without flow or sag—and temperatures as low as minus 20° F., without cracking or peeling. Easily applied by centrifugal spinning, rolling rig, or hand daubing.

Recommended specifications and complete information on any special protective coating problems will be supplied, promptly on request.

Reilly COAL TAR PRODUCTS

•

(Photographs reproduced here by permission of Los Angeles County Flood Control, San Gabriel Dam No. 1.)

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN · PLANTS · TO · SERVE · YOU

(*Continued from page vi*)

Resignations

MONTAUK BEACH DEVELOPMENT CORP. George Walker, Supt., Water Dept., Montauk, N. Y. (Corp. M.)

WILLETT, W. M. Gen. Mgr., Western United Gas & Electric Co., 70 Fox St., Aurora, Ill.

Transfers Between Sections

MR. JAMES R. COOK, from New York to West Virginia.

MR. HARRY L. KINSEL, from New York to Illinois.

MR. EDWIN L. GRIMES, from Southeastern to Virginia.

MR. ROBERT R. HARRIS, from New England to Kentucky-Tennessee.

(*Continued from page 32*)

Pay as you go basis is the plan for financing a 10-year, million dollar water works improvement for Columbus, Ohio, according to the Columbus State Journal. This plan is a substitute for the million dollar, partially P.W.A. financed plan that was rejected by the voters in 1936. Surplus revenue estimated as high as $1,520,000 between 1940 and 1950 will, according to Superintendent Clarence B. Hoover, be used to make necessary extensions and also replacements for some equipment which is as much as 30 years old.

Principle extension item is a new force main to increase pressure in the north, east, and central sections of the city. This will cost about $433,000. Also on the list are a new chemical house and equipment, one elevated water tank, two 500-hp. boilers, two new direct current generators, a direct service water pumping unit, a new raw water pump and raw water force main, a new settled water conduit, new flocculators in clarification tanks, and land and easements.

On the replacement or retirement list are four of the six boilers, two generators and two pumping engines, all of which are 30 years old. The other two boilers and one pumping unit have been in service 22 years. Mayor Gessaman says, "The program will give the city necessary improvements to the water works without requiring a bond issue. This will save several thousands of dollars in interest."

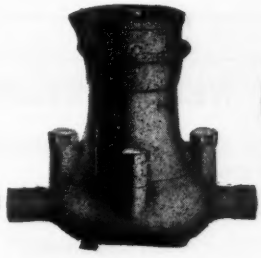
Plans which have been under consideration by the Kingdom of Greece for several years past to increase the water supply of Athens and its port, Piraeus, by means of a new aqueduct which would unite waters of the springs of the Boeotian Kephissos with those of Marathon Lake, are about to be given effect, it was revealed upon the arrival in this country of Thomas F. Devaney, vice-president of Ulen & Company, which constructed the Marathon dam for Greece in the early thirties.

(*Continued on page 38*)

Compare THESE STANDARDS OF ACCURACY

The American and New England Water Works Associations' Standard Specifications for 5/8″ cold water meters allow a range of 4% in accuracy within "normal test flow limits," these test flows being from a minimum of one gallon to a maximum of twenty gallons a minute. The "minimum test flow" of 1/4 gallon a minute demands an accuracy of 90% or better.

The Neptune Meter Company's Standard Specifications for the 5/8″ standard Trident Meters allow a range of *2.2%* in accuracy within "normal test flow limits," these test flows being from a minimum of one gallon to a maximum of twenty gallons a minute. The test flow of 1/4 gallon a minute demands an accuracy of 95% or better. *The "minimum test flow" of 1/8 gallon a minute demands an accuracy of 90% or better.*



SPLIT CASE

FROST PROOF

ONE RESULT OF THE PRECISION MANUFACTURE OF

TRIDENT WATER METERS

NEPTUNE METER CO., 50 WEST 50TH ST., N. Y. C.
NEPTUNE METERS LTD., 345 SORAUREN AVE., TORONTO

MABBS

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

A. W. W. A.
Membership Certificate

A fine newly designed parchment paper membership certificate for A. W. W. A. members is now available in 9 by 12 inch size, suitable for framing.

Give us your name—exactly as you wish it to appear. Send 40¢ in coins or postage to cover cost of lettering and mailing.

The certificate will reach you within 10 days of receipt of order —ready for you to frame and hang in your office.

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.

Lawrenceburg — Indiana

WELL SCREENS

To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.

2304 Long Avenue, St. Paul, Minn.

SAVE 80% ON YOUR TRENCHING COSTS WITH A

GIANT PIPE PUSHER

10 DIFFERENT SIZES TO FILL EVERY NEED

WRITE FOR CATALOG

Dept. P-3

GIANT MFG. CO.

Council Bluffs, Iowa

POMONA PUMPS

WATER LUBRICATED TURBINE

Oceans of Water

POMONA PUMP CO.

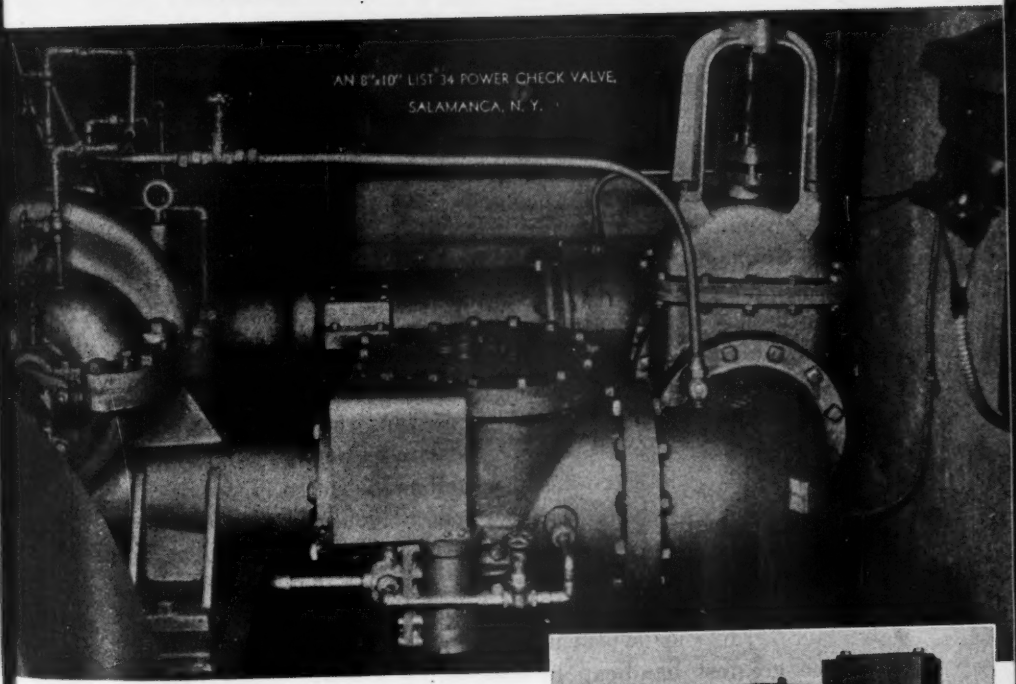
POMONA, CALIFORNIA

LOS ANGELES 639 S. MAIN ST. CHICAGO 53 W. JACKSON BLVD.

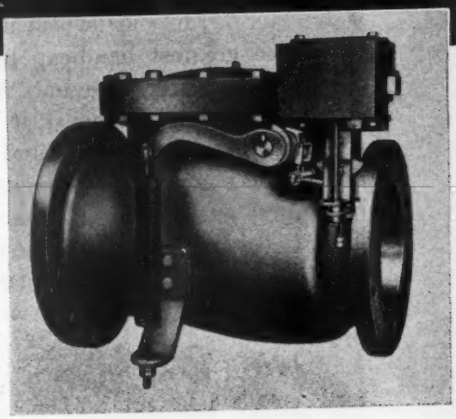
FOR QUIET CLOSURE & MAXIMUM EFFICIENCY—INSTALL

RENSSELAER

LIST 34 POWER CHECK VALVES



AN 8"x10" LIST 34 POWER CHECK VALVE,
SALAMANCA, N. Y.



Positively eliminates slam on pump shut-down.

Full clearway opening reduces head loss and cuts power costs.

Simplicity of design and rugged construction results in trouble-free operation over a period of years.

Bulletin "V" mailed on request

RENSSELAER VALVE COMPANY, TROY, N. Y.

James Donahue is dead. To the younger members of the A.W.W.A., Donahue was little known. To the men who were active about the turn of the century, he will be remembered as an association leader. He was a member of the Executive Committee in 1887 and Vice-President of the association in 1888. He was its President in 1894 and was elected an Honorary Member in 1925. Since the sale of the Davenport (Iowa) Water Company in 1927, Mr. Donahue has not been active in the field. His activity paralleled that of Diven, Benzenberg, Davis, Case, Sherrerd, Felix, French, Gwinn, and others who were devoted to the association in its early days.

Carrying on the activities of the Illinois Central Railroad Waste Avoidance Committee under the direction of A.W.W.A. member C. R. Knowles, the month of October has been selected to conduct a campaign on prevention of water waste. It is expected to accomplish a 10 per cent reduction in the cost of water during the month of October as compared with the average cost for the first five months of 1938.

This will be the fourth consecutive annual water waste campaign. The results accomplished during the previous three years follow:

1935—5.7 per cent reduction
1936—7.7 per cent reduction
1937—6.04 per cent reduction

"With the full cooperation of all employes we should have no difficulty in reaching the 10 per cent goal," said Mr. Knowles.

"Our city water bill for the year 1937 was $369,640, exclusive of the water pumped by our own facilities, or more than $1,000 per day."

"The greatest handicap in conducting a water waste campaign is the fact that water represents no particular value to many, and its waste is tolerated simply because it is water. Water in its natural state in rivers, lakes and in the ground does not represent any particular value, and to use a common expression "it is as free as the air we breathe" but it requires engines, boilers, pumps, pipe lines, wells, tanks and fuel and labor to bring it from its source to the point of use. For example, the City of Chicago with Lake Michigan at its front door has $131,000,000 now invested in its water system and spends nearly $10,000,000 per year to provide water.

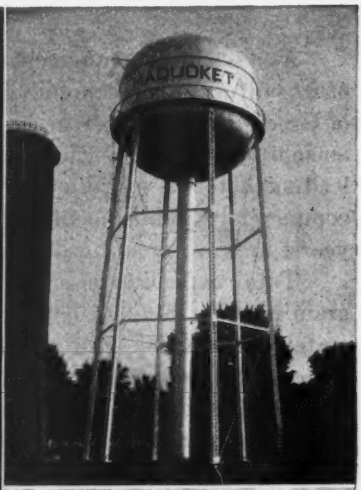
"Water, therefore, has a very definite value when flowing from a tank spout, faucet or other opening, and should be handled with the same economy as any other material. It is the one commodity used on a railroad that is handled by every employee and naturally offers more opportunity for waste."

P·DM

Means...

PROVED
DEPENDABLE
MATERIAL

Properly Designed and Manufactured



. . . This has been true for over forty years. ● In the building of Elevated Steel Tanks — as in all its manufacturing activities, Pittsburgh-Des Moines achieves the ideal of *Quality . . . at Lowest Cost*. Quality in intelligent design . . . quality in materials, full weight and honestly fabricated . . . quality in workmanship and erection —*at lowest cost to you* by means of modern efficiency in manufacture and the plain "know-how" of experience. Are Elevated Steel Tanks a present concern of yours? P·DM maintains a complete engineering advisory service at the disposal of any interested authority, without obligation. For a consultation, write to our nearest office—and ask for your copy of P·DM's 20-page "Modern Water Storage" Bulletin!

PITTSBURGH • DES MOINES STEEL CO.
PITTSBURGH, PA. 3424 NEVILLE ISLAND
DES MOINES, IA. 925 TUTTLE STREET
NEW YORK . . . . . ROOM 921-99, 270 BROADWAY
CHICAGO . . . 1228 FIRST NATIONAL BANK BUILDING
DALLAS . . . . . 1229 PRAETORIAN BUILDING
SAN FRANCISCO . . . . . 631 RIALTO BUILDING

(*Continued from page 38*)

As a result of an augmented water supply, Athens is enjoying a rebirth of its cultural and economic life and the present progressive Government of Greece desires the creation of an abundant supply of water so that the ancient city may continue its marked modern progress. One of the leading hotels is installing air-conditioning. New highways, schools and commercial establishments, which have been constructed in the last few years, are also creating demands for more water.

Total expenditure involved in the contemplated public works program is about $12,000,000, the first step calling for an outlay of approximately $3,000,000. An average force of about 1,800 men would be retained with a maximum of 4,500 at peak operations. Until the completion of the basic construction of the modern water works system now serving the Greek metropolis, the city had depended upon the aqueduct constructed during the reign of the Emperor Hadrian, which had served Athens and the surrounding communities for eighteen centuries, with only minor repairs. Prior to the Ulen construction, the 800,000 inhabitants of the city were limited to an average of ten quarts of water daily for all purposes.

Most houses were supplied with one or more metal tanks with capacities up to 500 gallons. If the pressure in the inadequate distribution system was sufficient, these tanks were placed on the roof and were filled by gravity. It was necessary in many parts of Athens to have two tanks, one at the ground level, to be filled from the main by gravity, and one on the roof, which was filled from the lower tank by a hand pump.

The city was divided into districts for distribution, and each subdivision was supplied with a limited quantity at more or less regular intervals, usually for one or two hours at intervals of four days. During this time house owners had to fill their receptacles. For the poorer houses, which had neither storage tanks nor connections to the mains, public taps or hydrants, known as fountains, were placed at convenient points about the city. There were more than 1,100 of these fountains, where long lines of women and boys often had to wait until one and two o'clock in the morning for their meager supply.

The most spectacular part of this modern project is Marathon Dam, the only large marble-faced dam in the world. Its length is 935 feet and it rises 177 feet above the river bed to an elevation of 745 feet above sea level. Ulen & Company constructed a complete distribution system and installed a purification plant during the operations. There were nearly 5,000 men engaged in the work at the peak of activity, practically the entire force being Greek, with the exception of the engineering staff and certain specialists.

The LOCK JOINT "Book of Experience"

Laying Pipe at Bogota, Colombia

9000 Feet Up in the Andes

THE hazards of towering mountains, precipitous slopes and deep valleys encountered at Bogota, Colombia, were safely and economically surmounted by the Lock Joint Pipe Company in the construction of a 15.8 mile High-Pressure, High-Capacity Concrete Pipe Line.

The citizens of Bogota are permanently assured of an abundant supply of mountain water, because of the enduring qualities built into every length of Lock Joint Reinforced Concrete Pipe.

LOCK JOINT PIPE CO., Ampere, New Jersey
PRESSURE : SUBAQUEOUS : SEWER : CULVERT

LOCK JOINT Reinforced CONCRETE PRESSURE PIPE

AMERICAN WATER WORKS ASSOCIATION

Headquarters Office

22 East 40th St., New York

Officers

President	REEVES NEWSOM Engineer-Consultant, 500 Fifth Avenue New York, N. Y
Treasurer	WILLIAM W. BRUSH
Secretary	HARRY E. JORDAN
Assistant Secretary	P. S. WILSON

Board of Directors

Representing the Local Sections

California Section	NELSON A. ECKART, San Francisco, Cal.	to–1939
Canadian Section	ALBERT E. BERRY, Toronto, Ont.	–1940
Central States Section	H. LLOYD NELSON, Philadelphia, Penna.	–1941
Florida Section	A. P. BLACK, Gainesville, Fla.	–1939
Four States Section	CHARLES H. BECKER, Philadelphia, Pa.	–1939
Illinois Section	HAROLD E. BABBITT, Urbana, Ill.	–1939
Indiana Section	H. A. DILL, Richmond, Ind.	–1940
Kentucky-Tennessee Sect.	E. E. JACOBSON, Lexington, Ky.	–1941
Michigan Section	GEORGE H. FENKELL, Detroit, Mich.	–1941
Minnesota Section	LEONARD N. THOMPSON, St. Paul, Minn.	–1939
Missouri Valley Section	EARLE L. WATERMAN, Iowa City, Iowa	–1941
Montana Section	JOSEPH M. SCHMIT, Lewistown, Mont.	–1939
New England Section	ROGER W. ESTY, Danvers, Mass.	–1941
New Jersey Section	SAMUEL F. NEWKIRK, Elizabeth, N. J.	–1941
New York Section	WILLIAM A. MCCAFFREY, Oswego, N. Y.	–1941
North Carolina Section	PAUL W. FRISK, Enka, N. C.	–1940
Ohio Section	WALLACE W. MOREHOUSE, Dayton, Ohio	–1939
Pacific Northwest Sect.	MILTON H. MCGUIRE, McMinnville, Oregon	–1941
Rocky Mountain Section	CHESTER A. TRUMAN, Colo. Sprgs., Colo.	–1940
Southeastern Section	J. K. MARQUIS, Spartanburg, S. C.	–1940
Southwest Section	JOHN B. WINDER, Dallas, Texas.	–1939
Virginia Section	MARSDEN C. SMITH, Richmond, Va.	–1940
West Virgina Section	MENTOR HETZER, Moundsville, W. Va.	–1940
Wisconsin Section	ARTHUR H. MILLER, Sheboygan, Wis.	–1940

Representing the Water Works Manufacturers Association

Manufacturer	DENIS F. O'BRIEN, East Orange, N. J.	–1939
Manufacturer	WILLARD T. CHEVALIER, New York, N. Y.	–1940
Manufacturer	CLINTON INGLEE, New York, N. Y.	–1941

Ex-Officio Members of the Board

President	REEVES NEWSOM, New York, N. Y.	–1940
Past President	EUGENE F. DUGGER, Newport News, Va.	–1939
Treasurer	WILLIAM W. BRUSH, New York, N. Y.	–1939
Ch.W.W. Practice Comm.	MALCOLM PIRNIE, New York, N. Y.	–1939
Ch. Publication Comm.	LINN H. ENSLOW, New York, N. Y.	–1939

Officers of the Divisions

Finance and Accounting Division.—Chairman, M. F. HOFFMAN; Vice-Chairman, DALE L. MAFFITT; Secretary-Treasurer, WILLIAM J. SCHWARTZ; Directors, JACOB SCHWARTZ, HAL F. SMITH.

Plant Management and Operation Division.—Chairman, THOMAS L. AMISS; Vice-Chairman, A. P. KURANZ; Secretary-Treasurer, D. D. GROSS; Directors, SAMUEL F. NEWKIRK, L. S. VANCE.

Water Purification Division.—Chairman, CHARLES GILMAN HYDE; Vice-Chairman, CHARLES H. SPAULDING; Secretary-Treasurer, CHARLES R. COX; Past Chairman, WILLIAM M. WALLACE; Additional members of Executive Committee, M. C. SMITH, PAUL WEIR.

Lithographed on stone by James E. Allen for U. S. Pipe & Foundry Co.
Copyright, 1937, U. S. Pipe & Foundry Co.

PRICE per foot installed **is an uncertain index of the eventual cost of an underground main which is intended as a permanent installation. The real yardstick is the *cost per service year*. With a useful life of more than 100 years—with maintenance cost either nil or negligible—cast iron pipe is by far the lowest-cost material on a service year basis. This is a matter of record.**

UNITED STATES PIPE & FOUNDRY CO., BURLINGTON, NEW JERSEY

Foundries and Sales Offices throughout the U. S. A.

Makers of U. S. Super-de Lavaud Centrifugally Cast Pipe and U. S. Pit Cast Pipe

U. S. CAST IRON PIPE

Officers of the Sections

Section	Chairman	Vice-Chairman	Secretary-Treasurer	Past-Chairman	Other Members of the Section Governing Board[1]
California	H. Reinhardt	F. S. Porter	B. S. Grant	J. E. Phillips	J. Barker, C. Hoskinson, M. Jones, B. Livingstone, J. Longwell
Canadian	A. B. Manson	—	A. E. Berry	E. V. Buchanan	C. E. Brown, L. G. McNeice, R. J. Smith, G. H. Strickland, F. G. Browne, W. Storrie, W. T. Randall.
Central States	C. H. Young	E. A. Johnson	E. P. Johnson	E. C. Trax	J. Dunwoody, M. Mansfield, A. Martin
Florida	T. M.Lowe	G. F. Catlett	J. R. Hoy	D. S. Wallace	R. G. Ridgely, G. Kingsley, K. R. Chinn, F. R. Mills, W. B. Gibson
Four States	C. J. Lauter	I. M. Glace	C. A. Hechmer	H. M. Freeburn	E. Hopkins, G. Wirtz, R. Beckett, J. DeGroot.
Illinois	W. D. Gerber	F. G. Gordon	C. W. Klassen	F. C. Amsbary	G. B. Prindle, H. H. Gerstein.
Indiana	P. C. Laux	M. H. Schwartz	J. A. Bruhn	J. L. Ford	C. L. Link.
Kentucky-Tenn.	C. M. McCord	H. Arnold	H. D. Schmidt	E. E. Jacobson	H. C. Bristol, H. N. Jernigan.
Michigan	C. R. Bird	R. J. LaMarre	M. N. Gerardy	E. E. Norman	R. Faust, H. Caswell.
Minnesota	J. A. Jensen	E. M. Grime	R. M. Finch	F. Seligman	A. Janzig, C. Elliott, U. Seibert.
Missouri Valley	B. L. Ulrich	J. C. Detweiler	E. L. Waterman	D. L. Maffitt	J. Dean, T. Filipi, E. Hopkins, E. Mathews, C. Patchen.
Montana	G. E. Atkinson	C. W. Eyer	H. B. Foote	R. N. Arnold	D. S. Thomas, Kurt Wiel
New England	S. S. Anthony	F. A. Marston	S. M. Ellsworth	W. J. Scott	H. W. Griswold, P. A. Shaw.
New Jersey	W. R. Conard	G. F. Wieghardt	H. N. Lendall	S. F. Newkirk	J. A. Carr, C. H. Capen.
New York	E. L. H. Meyer	F. Henshaw	R. K. Blanchard	A. D. Drake	C. R. Cox, E. K. Wilson.
North Carolina	W. M. Piatt	D. S. Abell	A. R. Hollett	J. W. Kellogg	
Ohio	W. R. LaDue	W. C. Lawrence	T. R. Lathrop	—	C. Inman, P. Burgess, M. Hoffman.
Pacif. Northwest	N. A. Gilman	T. H. Judd	F. Merryfield	M. H. McGuire	R. E. Koon, M. K. Snyder
Rocky Mountain	L. O. Williams	—	B. V. Howe	O. J. Ripple	B. Coy, J. Soderstrum, K. Darling, R. Streeter, E. Bradner, C. Riddell.
Southeastern	C. P. Townsend	P. Weir	B. P. Rice	D. R. Pringle	F. G. Crow, M. G. Stewart, J. H. McLure, H. F. Wiedeman
Southwest	A. R. Davis	M. B. Cunningham	L. A. Quigley	T. L. Amiss	A. Brenneke, W. McMurry, J. Montgomery, A. Theard.
Virginia	H. A. Johnson	W. G. Myers	H. W. Snidow[2]	H. B. Rice	E. Meredith,[2] R. Leveque.
West Virginia	T. L. Young	W. Kirchman	J. B. Harrington	A. R. Todd	A. Rhoads, H. Speiden, G. Underwood.
	W. C. Staeffler	A. E. Hintz	L. A. Smith	W. U. Gallaher	J. Myers

[1] For Section's representative on the A. W. W. A. Board of Directors, see list on page ii
[2] Virginia Section—Secretary is H. W. Snidow; Treasurer E. C. Meredith

COMING MEETINGS

December 29—New York Section, at Hotel Pennsylvania, New York, N. Y. Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

April 10-12—Kentucky-Tennessee Section, at Memphis, Tenn. Secretary, H. D. Schmidt, State Dept. of Health, Nashville, Tenn.

April 12-14—Canadian Section, at Royal York Hotel, Toronto, Ont. Secretary, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

April 25-26—Indiana Section, at Indianapolis, Ind. Secretary, J. A. Bruhn, Box 855, Indianapolis, Ind.

April 27-28—Ohio Section, at Dayton, Ohio. Secretary T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

***June 11-15*—American Water Works Association Annual Convention, at Atlantic City, N. J.**

See page 27 (advertising section) for hotels and rates.

CHANGES IN MEMBERSHIP

New Members, Applications Received Sept. 1 to 30, 1938

ADAMS, ROBERT WYNN. Hydraulic & San. Engr., Civil Eng. Dept., Miss. State College, State College, Miss.

BOLING, FRED. Supt., West Terre Haute Utilities Co., 500 National Ave., West Terre Haute, Ind.

BROWN, W. DICKSON. Sales Repr., Farnan Brass Works Co., East Side, Sheridan Road, Saginaw, Mich.

CLARK, OWEN E. Construction Engr., Division of Water, 110 Cherry St., Toledo, Ohio.

COUSINS, J. E. JR. Representative, Layne Atlantic Co., P. O. Box 592, Albany, Ga.

DALEE, WILLIAM A. Pres., Wm. A. DALee Inc., 4835 Woodward Ave., Detroit, Mich.

ELLERBUSCH, R. P. Sanitarian, State Board of Health, Huntingburg, Ind.

ELWELL, PAUL W. Cons. Mun. Engr., 5005 Euclid Ave., Cleveland, Ohio.

FISHER RESEARCH LABORATORIES. Mr. Gerhard R. Fisher, Repr., 745 Emerson St., Palo Alto, Calif. (Asso. M.)

GALLOWAY, JAMES L. Supt. of Filtration, Water Dept., Marysville, Mich.

GASSERT, H. T. Water Works Supt., Holyoke, Colo.

HORNSHAW, JAMES E. Asst. Civil Engr., 13376 Hubbell Ave., Detroit, Mich.

HOLST, J. E. Supt. & Chemist, Water Dept., City Hall, Mitchell, So. Dak.

HUGHART, J. H. P. Mgr. Transite Pipe Section, Johns-Manville Sales Corp., 222 North Bank Drive, Chicago, Ill.

HUTCHINS, R. T. Supt. of Water Dept., 209 West Franklin Ave., El Segundo, Calif.

JACKSON, H. W. Sanitarian, State Board of Health, 108 W. Second St., Bloomington, Ind.

JACKSON, J. A. Sanitarian, State Board of Health, Bolte Bldg., Huntingburg, Ind.

LEMAY, ANDY L. Water Supt., Oreville, Wash.

LIFFIN, JOHN JAMES. Exec. Engr., Associated London Properties, Ltd., St. Ermins, Caxton St., Westminster, London, England.

LONGVIEW MUNICIPAL WATER WORKS. Mr. Wolff, Supervisor of Public Works, Longview, Texas (Corp. M.)

MASTERS, L. S. Repr., Neptune Meter Co., Battles Wharf, Ala.

MCGAUHEY, P. H. Associate Prof. of San. Eng., Virginia Polytechnic Institute, Blacksburg, Va.

MCDIARMID, DAVID MIDDLETON. B. Sc., A.M.I.C.E., Sr. Exec. Engr., Malayan Public Works Service, Kuala Lumpur, Federated Malay States.

MILLAR, ROBT. S. Mgr., The St. Joseph Water Co., 825 Francis St., St. Joseph, Mo.

MUNICIPAL WATER WORKS. Mr. Joe W. Lovell, 129 E. Main St., Murfreesboro, Tenn. (Corp. M.)

NEHI, INC. Mr. Kennon Mott, General Production Mgr., Columbus, Ga. (Corp. M.)

PATTEN, G. H. Supt., Village of Rockville Center, 50 Powell Ave., Rockville Center, L. I., N. Y.

PORTER, HERMAN G. Sanitarian, Indiana State Board of Health, 225 West Broadway, Princeton, Ind.

RUBBO, JACOB F. Operator, Iron Mountain Water Works, 626 Stanton St., Iron Mountain, Wyo.

SCHIRK, J. M. Asst. State Director, Community Sanitation, State Health Dept., Cheyenne, Wyo.

SMITH, LOUIS P. Pres. & Gen. Mgr., Farnan Brass Works Co., 1104 Center St., N. W., Cleveland, Ohio.

SMITH, R. BEVERSTOCK. Vice Pres. & Treas., Farnan Brass Works Co., 1104 Center St., N. W., Cleveland, Ohio.

STRADER, ALFRED A. Meter & Service Inspector, Dept. of Water & Power, 245 S. Harvard Blvd., Los Angeles, Calif.

THOMAS, KEN C. Sales Mgr., Virginia Culvert Corp., P. O. Box 415, Richmond, Va.

TWINING, R. H. Mgr. Development Dept., The Gray Chemical Co., Roulette, Pa.

WILLIAMSON, LEWIS A. Div. Mgr., California Water & Telephone Co., 601 Lighthouse Ave., Pacific Grove, Calif.

WILLIS, WILLET R. Chemist & Bacteriologist, 1343 N. Nevada Ave., Colorado Springs, Colo.

(*Continued on page 36*)

NEWS OF THE FIELD

The American Water Works Association is growing at a rate of which every member should be proud. Its sections, one by one, as they have their meetings, exceed all previous records for attendance and enthusiasm. Much of its technical committee work is moving at a rate which evidences the ability of members to cooperate constructively for the benefit of the profession.

At the end of October, the membership total was 3,436. This is a gain of 372 since the first of the year. Since the first of 1937 the gain has amounted to 712. Upon the basis of the total of 2,724 at the beginning of 1937, this represents a gain of more than 26 per cent. The gratifying feature of this is the fact that it results from no promotional drive or campaign, but from the activities of men over all of North America who have a loyal interest in the association and who are bringing the association to the attention of others whom they know should be members.

When the meetings of the Minnesota, Wisconsin, Missouri Valley, Southwest and California Sections were over, it was the delight of the members of each then present to learn that the largest number of registrations ever recorded at the respective section meetings had been reached at the 1938 session. No better evidence of Association health and vigor can be given than by the attendance at section meetings. The papers presented have been excellent and the discussions have been free and active.

Committee work forges ahead. The Meter Specifications Committee, led by Sam Newkirk of Elizabeth, N. J., is at work exchanging preliminary ideas. A draft of the new specification is in preparation for the committee to discuss and the evidence is that an open forum on the subject can be held at the Atlantic City Convention.

Truly, your association is on the march. You should be proud of it. What do you want to do to help?

The **Atlantic City Convention** dates are definitely set for June 11–15, 1939. The exhibits and technical sessions will be held in the magnificent auditorium. The housing headquarters are the Ambassador and Chelsea Hotels, side by side on the boardwalk, just three very short blocks from the auditorium. Reservations are already being made at a rapid rate. Members should consult the rate schedule on page 27 of the advertising section and make their reservations promptly. While there have been over 900 rooms put aside for A. W. W. A. use, there is every prospect of a record breaking convention and no reason why any person should delay making

(Continued on page 2)

(*Continued from page 1*)

reservations if he is planning to attend. Every year an agreement is made with the headquarters hotels covering rates, etc. Certain sections of the Atlantic City agreement are reproduced herewith for the information of all members.

"We agree to make room reservations for the convention period for the use by the occupants only for housing and such social purposes as are normally associated with the use of hotel living quarters. We expressly agree to permit no display of equipment or merchandise relating to the water supply or any other allied industry at any place within the hotel.

"We agree to accept reservations for the convention period from persons and firms whom we have reason to believe are entitled to make such reservations. When we have accepted reservations up to the limit of our proposal, we agree to refer to the Atlantic City Convention Bureau all additional requests for accommodations, to be handled by them.

"We agree to file with the Secretary of the American Water Works Association a copy of each reservation acceptance as it is made. We further agree to make for no single person or firm, nor for persons and/or firms which we have reason to believe are associated, reservations sufficient to house more than twenty persons until such reservations are approved by the Secretary of the American Water Works Association."

These agreements are being carefully followed by Mr. William Hamilton, Manager of the Ambassador Hotel, and by Mr. Julian A. Hillman, Manager of the Chelsea Hotel. A. W. W. A. members will do themselves a service by giving full cooperation.

Willard C. Lawrence, a veteran of 31 years in the City Utilities Dept. of Cleveland, Ohio, has been appointed commissioner of water and heat of that city. He succeeds L. A. Quayle, chief engineer, who has been acting commissioner since 1935, but who has relinquished those additional duties to direct the department's new engineering offices. Mr. Quayle will continue as consultant to the water and heat division.

Mr. Lawrence started as a clerk in the department in 1907 at 22 cents an hour, rose to become superintendent of filtration at the Baldwin filter plant. He has twice before, according to Frank O. Wallene, utilities director of Cleveland, been offered the commissionership. Mr. Lawrence is a native Clevelander, was educated in Cleveland and at Hiram College.

"Seasonal Temperature Variations in Relation to Water Treatment" was the title of an article by Blair Burnson, of the East Bay Municipal Utility District, Oakland, California, which appeared in the May, 1938

(*Continued on page 4*)

Nothing takes the place of

GRAVITY

Nothing takes the place of

CAST IRON PIPE

THE tree from which Newton's apple fell was cut down in 1820. A cast iron underground main, laid in Newton's boyhood (1664) is still rendering satisfactory service. No one will argue the unique necessity of the law of gravity. Few will argue the indispensability of cast iron pipe for underground mains.

If you want proved long life and low maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—and permanently tight joints—then you will agree that nothing takes the place of cast iron pipe. Some materials meet some of these requirements but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE

The Standard Material Q *for Underground Mains*

(*Continued from page 2*)

issue of the Journal of the American Water Works Association. This informative article appeared to contain certain sentences similar to the text of *The Microscopy of Drinking Water* by Fair and Whipple. A study of the author's notes indicates that these sentences were part of a group of notes taken at the time he was carrying on a course in sanitary engineering. It would thus appear that the value of the Fair and Whipple text on the microscopy of drinking water is doubly evident by its wide use as a reference volume in the university training field.

A rare editorial is this one to compare with the usual type that solves all the technical and financial problems to the utmost satisfaction of the layman wherever a water works project is under way:

"Recently a friend asked the editor why he had not taken a stand editorially on the water question—wondered if we were 'on the spot' and had to keep still. Not at all. The people elected a competent board of

(*Continued on page 6*)

. . . . . and the SAME goes for this BETTER JOINTING COMPOUND

A duck's back has nothing on Tegul-MINERALEAD. Rain, snow or flood don't bother those 10 lb. ingots. Your stock of this compound can be under water for days—weeks, and it won't matter a bit. When you're ready to go to work, it, too, will be ready • Joints made with this sulfur base compound heal quickly. Back filling can be started immediately, ending traffic hazards due to open trenches • Joints are permanently tight and withstand any vibration • For more information about this better compound for jointing Bell and Spigot Main, write The ATLAS MINERAL Products Company of Penna., Mertztown, Pennsylvania.

Tegul

A Tegul PRODUCT

MINERALEAD

More Than

400,000 FEET of MONO-CAST ENAMELINE PIPE

Now in Service!

WRITE for literature on this new Cast Iron Pipe lining which positively prevents tuberculation, reduces friction of flow, maintains permanent high "C" values and materially lowers pumping costs.

AMERICAN CAST IRON PIPE CO.

BIRMINGHAM, ALA.

New York City Chicago Kansas City Minneapolis Dallas
Los Angeles San Francisco Pittsburgh Cleveland

MATHIESON CHLORINE SERVES LINCOLN SEWAGE PLANT

Says Wardner G. Scott, Engineer, Sanitary District Number One of Lancaster County, Nebraska:

"The quality of Mathieson Liquid Chlorine, together with the prompt service on shipments has been entirely satisfactory at all times."

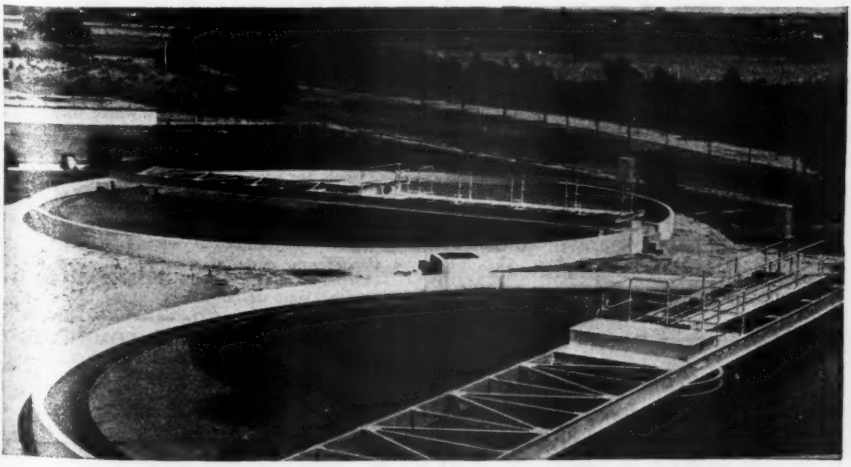
ABOVE all else, whether the job in hand be water purification, sewage treatment or swimming pool sanitation, your supply of liquid chlorine must be dependable. You have a right to expect at all times a pure product, trouble-free containers and valves, prompt delivery service.

At Lincoln, Nebraska, where the sewage treatment plant uses chlorine in ton containers, Mathieson Liquid Chlorine has been proving its dependability over a period of years. As Mr. Scott states, he has found the quality of the product and the prompt service on shipments entirely satisfactory at all times.

Because so many sanitary officials have had the same experience as Mr. Scott, they have learned to specify Mathieson whenever there is a chlorinating job to be done.

The MATHIESON ALKALI WORKS (Inc.)
60 East 42nd Street New York, N. Y.

Soda Ash . . . Liquid Chlorine . . . Bicarbonate of Soda . . HTH and HTH-15 . . . Caustic Soda . . . Bleaching Powder . . . Ammonia, Anhydrous and Aqua . . . PH-Plus (Fused Alkali) . . . Dry Ice (Carbon Dioxide Ice)



(*Continued from page 4*)

trustees and they have secured the best engineering advice possible and arrived at a unanimous decision, based on the reports of two firms of engineers. We have endeavored to give all the news completely and without prejudice but it was no time for a layman to give advice.

"The questions involved are largely technical and the average layman does not have sufficient information to form an opinion based on facts. Most of us have prejudices but it needs a good deal more than that for official action and the trustees have wisely consulted the men who are recognized authorities in such matters. . . .

"That there have been differences of opinion in the official family is not surprising. On a problem as complicated as this, the surprise is that six out of seven agreed on a program. The men are all conscientious; they have given the subject thorough study based on the reports of the most competent engineers available; the plan has been approved by the state health department; the bonds have been sold at a premium; the bids have been substantially under the engineers' estimates. The people . . .can well rely on the judgment and decisions of the men they have elected to the village board. No set of public officials has ever studied a problem

(*Continued on page 7*)

INTRODUCING

Trade RUSTA RESTOR Mark

(Patents Pending)

An electrical appliance which eliminates Rusting, Corrosion, Pitting and Painting below the water line in water tanks.

Costs about as much as a coat of paint to own, and less than 50¢ a month to operate.

Full particulars on request.
Write
RUSTA RESTOR CORPORATION
FREMONT, OHIO

LET EVERYONE KNOW THAT

CANCER

CAN BE

CURED

BUT TREATMENT MUST BE STARTED IN TIME

Pin $1.00 or more to the coupon below. It will be spent

1. To enable this Committee to maintain its offices, to distribute free literature and exhibits in schools and institutions, and to direct thousands of sufferers to physicians and hospitals where they can receive treatment, either free or in proportion to their ability to pay.
2. To furnish you with a supply of labels for your packages.
3. To send you the Quarterly Review of the New York City Cancer Committee, containing valuable articles on the diagnosis and treatment of cancer.

Cancer now costs America 140,000 lives a year. You may save one of these lives by sending your dollar today.

TO

NEW YORK CITY CANCER COMMITTEE
130 East 66th Street, New York

I enclose $1.00. Send me the Quarterly Review for a year, and also a supply of labels. Devote the balance to your work.

*Name*_____

*Address*_____

If you are not a resident of N. Y. C. or Long Island, write for information to the American Society for the Control of Cancer, 1250 Sixth Avenue, New York.

ELEVATED TANKS

. . . improve pressures
. . . reduce pumping costs

Elevated storage meets peak load demands, maintaining uniform pressures in waterworks distribution systems and enabling pumping equipment to be operated at more uniform rates. The radial-cone design, illustrated here has a low range in head between the upper and lower water levels. Write our nearest office for information or estimating figures on installations.

CHICAGO BRIDGE & IRON COMPANY

Chicago.....Old Colony Bldg.
Birmingham.....1500 N. 50th Street
Boston.....Consolidated Gas Bldg.
Cleveland.....Rockefeller Bldg.
Dallas.....Liberty Bank Bldg.
Detroit.....Lafayette Bldg.
Houston.....2919 Main Street
Los Angeles.....Wm. Fox Bldg.
New York.....165 Broadway Bldg.
Philadelphia.....1700 Walnut Street Bldg.
San Francisco.....Rialto Bldg.
Tulsa.....Hunt Bldg.

Plants at BIRMINGHAM, CHICAGO and GREENVILLE, PA.

(*Continued from page 6*)

more carefully or spent more time in arriving at what they thought was for the best interests of the village.

"Differences of opinion are to be expected. The time to worry is when public officials become indifferent and have no opinions and no special interest in the welfare of the people. . . ."—*Citizen*, LaGrange, Ill.

Greenville City Water Works, Greenville, S.C., has received approval of a $1,867,272 loan and grant from the PWA. According to Superintendent J. L. Hawkins, this money will be used to lay 134,000 feet of 30-inch supply main from Greenville's Table Rock Reservoir in the Blue Ridge Mountains to the city. In addition to this line, the city proposes to build an equalizing reservoir with a capacity of 18,500,000 gallons, a small treating plant and a caretaker's house. The additional supply main will give the city a total capacity of 15,000,000 gallons a day.

The **first short school** of the Pacific Northwest Section was held October 13–15, in Seattle at the University of Washington. Cooperating

(*Continued on page 8*)

(*Continued from page 7*)

in carrying out the short school session were: the Dept. of Health, the Civil Engineering Dept. of the University of Washington, the Pacific Northwest Section of the A. W. W. A., and the Pacific Northwest Sewage Works Association. There was a total of eighty-six men registered. Leading discussions and presiding at discussions were: Roy M. Harris, Dr. Donald G. Evans, Paul Seufer, W. P. Hughes, Carl E. Green, E. A. Heiss, Paul Braun, Prof. R. B. VanHorn, M. S. Campbell, Prof. I. N. Carter, Prof. R. G. Tyler, R. B. Thompson, and Prof. C. W. Harris.

Bondholders have demanded a raise in rates in Jerseyville, Illinois. The water works has been in receivership since 1929. The indebtedness of the plant is $277,000, consisting mainly of a bond issue floated in 1922 and interest. Bondholders are attempting to raise the quarterly rates from $3 to $4.50. Previous litigation to raise the rates had been declared improper, but the Court of Appeals overruled the decision and ordered the lower court to set the rates. It is claimed that an Illinois law provides that under such circumstances the water rates must be raised so that interest and maturing bonds may be paid. The municipality is opposing the raise on the ground that private owners will have to share the burden.

(*Continued on page 10*)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

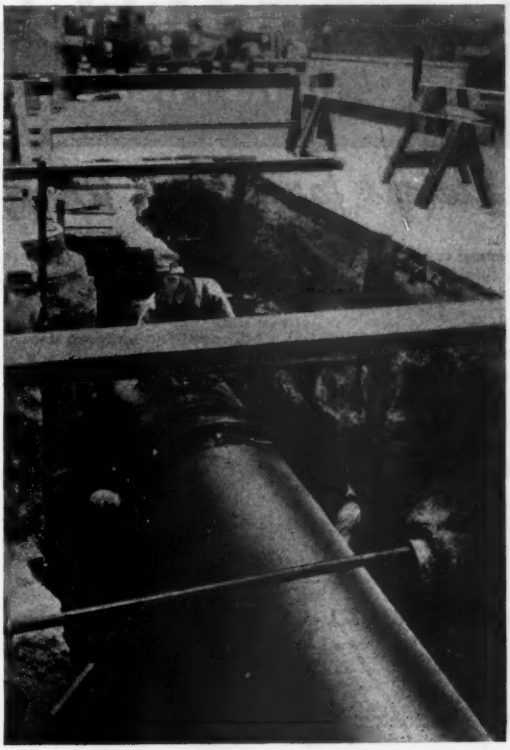
Hand Operated—size 2", 2½", 3", 4"
Power Operated—size 3" and 4"
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

THE ANSWER TO A PROBLEM

ALCO PIPE FOR CHICAGO



Cities using ALCO STEEL PIPE include the following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W Va
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y
New Brunswick, N.J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

The Water Department of Chicago and the Chicago Union Station were jointly and seriously concerned about the material to use in the 36" line to replace pipe running under the tracks of the station. The answer, illustrated above, is Alco Electric Welded Steel Pipe. No further need to worry about disastrous breaks.

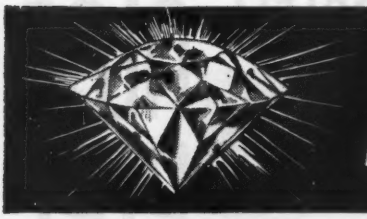
ALCO FEATURES

Greater Strength
Longer Life
Smoother Waterway
Longer Lengths
Fewer Field Joints
Low Initial Cost
Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS DIVISION
30 Church Street New York, N. Y.
CHICAGO WASHINGTON PITTSBURGH HOUSTON TULSA
Plants at Dunkirk, N. Y., and Montreal, Canada
Cable Address: Alproducts

AMERICAN LOCOMOTIVE COMPANY



CARBON
In Its Highest Form

But Valueless for Water Purification

Although the diamond is carbon in its most valuable form, it is worthless compared to CLIFFCHAR ACTIVATED CARBON for water purification.

Leading municipalities place high value on CLIFFCHAR to remove objectionable taste and odors from water supply.

CLIFFCHAR "R"
Special Grade for Water Purification

Low phenol value, shown by standard phenol tests, gives high ability to remove phenolic and similar compounds.

Extreme fineness (99% passing a 325 mesh screen) gives maximum surface exposure and adsorptive capacity.

Controlled, uniform density assures sufficient suspension period to take full advantage of its high adsorptive ability, yet settle out in ordinary settling basins.

The technical and laboratory facilities of this company are available without obligation to those concerned with taste and odor problems in water purification. Your inquiry is invited.

Cliffs Dow
REG U. S. PAT. OFF.

CLIFFS DOW CHEMICAL COMPANY, Marquette, Michigan
Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Sts., St. Louis; Field Bldg., Chicago

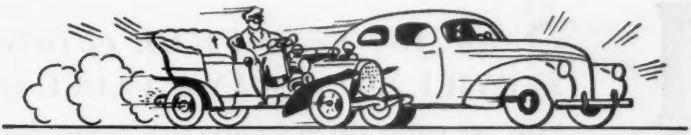
(*Continued from page 8*)

The Illinois River may be clean within a year or two. Requests for federal grants have been made or other steps have been taken toward construction of sewage disposal plants in cities along the river. Pekin, Peru, Marseilles, Ottawa, Joliet, Morris, LaSalle, Oglesby and Havanna have all signified to the State Sanitary Water Board that they intend to cooperate to free the river of gross pollution from municipal sources. The board's general program is expected to enhance the value of the Illinois River as a recreational area.

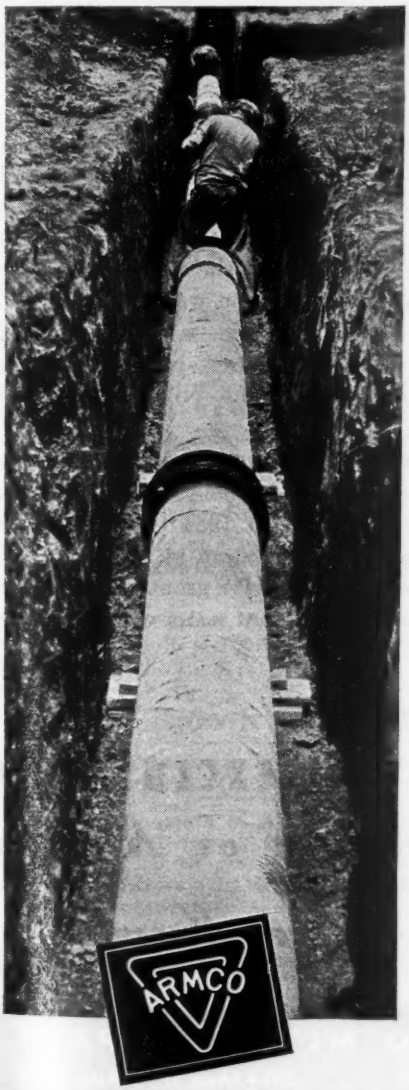
Water meters are being moved to the curb in Portsmouth, Ohio. Work is under way on transferring 3,000 domestic meters from homes to curb boxes. When this is accomplished, the city will have 10,105 outside meters. The only ones remaining inside will be those in hotels and some business houses.

The last bonded indebtedness on its water and light plant was paid by Metropolis, Illinois in September. This is the first time these plants have been free of bonded indebtedness since 1892 when the original plant

(*Continued on page 12*)



IDEAS ABOUT WATER LINES HAVE CHANGED, TOO



Here is a typical example that explains why so many cities have changed to welded steel pipe for water supply lines and force mains:

Investigations in one large city disclosed an average cost of $125.00 per mile per year to repair breaks and leaky joints in existing water lines. In the aggregate this has amounted to an excessively high annual maintenance expense—not to mention loss of water and frequent interruptions in service.

Now progressive cities are eliminating costly breaks and joint leaks by using Armco Spiral Welded Pipe with flexible mechanical couplings. These cities also report additional savings due to lower cost installed; higher flow capacity; and lower pumping costs. Let us help you achieve the same desirable results. The American Rolling Mill Company, Pipe Sales Division, 3481 Curtis Street, Middletown, Ohio.

In laying this four-mile water supply line, all unnecessary joints were eliminated and installation costs greatly reduced because Armco Spiral Welded Pipe was supplied in exact 40-ft. lengths.

ARMCO SPIRAL WELDED PIPE

Send for your FREE catalog on
SERVICE, ROADWAY & VALVE BOXES

• This new catalog just off the press illustrates our complete line of Service, Roadway, Valve and Gas Drip Boxes. No Water Works Official can afford to be without it. It features our New Improved Monitor Service Box with cover that can't work loose. Write now for a copy. Address Dept. C

THE CENTRAL FOUNDRY COMPANY
General Offices: 386 FOURTH AVENUE, NEW YORK
CHICAGO, ILL., 1105 W. 36th St. • OAKLAND, CALIF., 278 Fourth St.

(*Continued from page 10*)

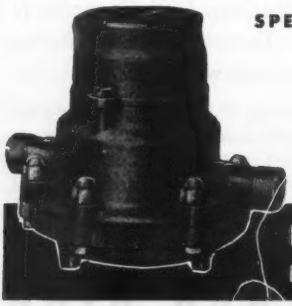
was built. The present water and light plant was built in 1924 and its collections have averaged nearly $60,000 annually over a ten-year period (1926–35). Out of 57 towns, cities and villages in the state of Illinois who have municipal water and light plants, according to the 1938 report of the Illinois Municipal Electric Service, Metropolis has the fifth lowest rate on electricity and the lowest combination flat rate on water rentals.

Foreclosure on the Northport, Michigan water system has been started by the Reconstruction Finance Corp. The Northport *Leader* says:

". . .The village of Northport was served with the necessary papers whereby the RFC gave notice of the starting of foreclosure proceedings against the Northport Water Works System. In 1934 the village entertained a project to construct a water works system at an expense of $32,000. The sum of $5,000 was obtained on a WPA grant, the balance or $27,000 was obtained through the sale of 4 per cent water works revenue bonds to the U. S. Government.

(*Continued on page 14*)

FIRST QUALITY METERS EXCLUSIVELY



SPECIFY *American* or *Niagara*
(BRONZE CASE) (IRON CASE)
Water Meters
WRITE FOR CATALOG

BUFFALO METER COMPANY
Established 1892 2914 Main St., Buffalo, N. Y.

FRED E. STUART
President

ALBERT C. BRUMLEY
Vice-President

BURTON W. GRAHAM
Chief Chemist

Activated Alum Corporation Tells Its Plans *for 1939*

1 If we knew anything *better* we could do for the Water Works Industry than make good Activated Alum and Blackalum, we would do it.

2 We have developed new processes—constructed new equipment—to produce *for 1939 Alum with a remarkable new basic material—INSOLUBLE SILICATES*—which we think is the most advanced Alum discovery in years.

3 Our new processes have helped us put more value into our Alums for 1939 —*that means more savings* to the buyer.

4 *We see to it that our customers always profit.* No sale is economically constructive unless it profits the buyer as much as, or more than, the seller.

5 We know that our 1939 Activated Alum and Activated Blackalum are Alums of good quality. We think they're fine values and we ask that you include them in your specifications for 1939.

6 With new products, new processes, and new equipment, *the Activated Alum Corporation is ready to go forward in 1939.*. HOW ABOUT LETTING US HELP YOU!

Now it's Wilmington AGAIN—

For 1939 Wilmington, North Carolina, *among many others*, picks Activated Alum AGAIN.

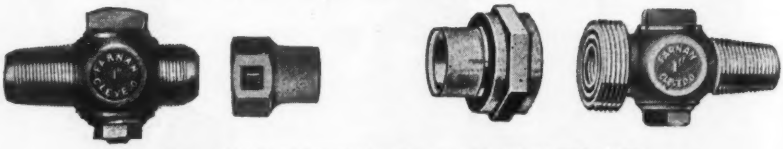
All present users of Activated Alum and Blackalum will be happy to know that *during the month of October we manufactured and shipped 2,530,000 pounds (1,265 tons) of Activated Alum and Blackalum* to others who likewise have picked these coagulants for their routine requirements.

What better testimonial could you want to prove to you that your decision to use these products is the proper one?

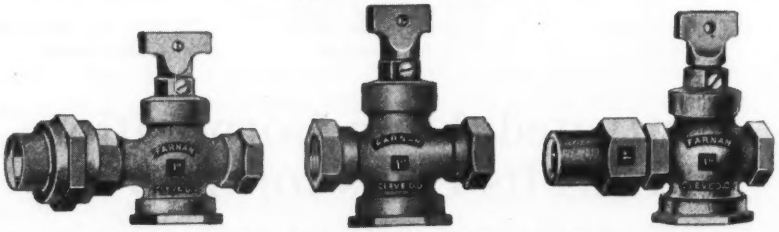
ACTIVATED ALUM CORP.

New York Office—80 Broad Street, New York City, N. Y.
General Office and Works—Curtis Bay, Baltimore, Maryland

Better Service Connections When
YOU SPECIFY "FARNAN"



OUR COMPLETE LINE CONSISTS OF CORPORATION AND CURB STOPS, COUPLINGS AND FITTINGS FOR COPPER, LEAD AND IRON SERVICES



FARNAN BRASS WORKS CO.
CLEVELAND *ESTABLISHED 1852* **OHIO**

(*Continued from page 12*)

"To protect the RFC the village gave the corporation a mortgage on the water works. The corporation seeks to foreclose on the mortgage because the village has been unable to meet its retirement plan on the bonds. Just what will be the result of government ownership, if the foreclosure is completed, is unknown. Local officials do know that current revenues are not capable of producing a bond retirement fund over and above running expenses. Water rates can only be so high, and there are only so many potential users. If this will not combine to pay operating costs and retire the installation debt, then, it is said by those who know the local situation, the original cost was too high."

Somerset, Ohio, which had only dry wells as a source of supply in late summer, now has a limited supply of water in the mains of its three-year old system. Under direction of an engineer from the Reconstruction Finance Corp. and with the cooperation of a finance officer from the same organization, a new well already has been drilled, one of the old ones has been deepened, and preparation has been made for drilling another. Consumers have been asked to use as little water as possible until a new

(*Continued on page 15*)

(*Continued from page 14*)

pump is installed in one of the new wells; then the federally subsidized system will again meet the water demand of the village.

Re-location of a mile of main was accomplished with the use of only a few hundred feet of new pipe at Delaware, Ohio while the main was used to carry the city's supply. The 16-inch line had to be moved 45 feet because the highway was being widened. Delaware uses about 750,000 gallons daily and has a 250,000-gallon elevated tank for storage. The work was to be done with WPA labor. The main was laid in 1888 and carried well water. In 1919 a filtering plant was installed and the old main was taken up, cleaned, and relaid.

First operation in carrying out the re-locating project was the laying of several hundred feet of new pipe in the new location, 45 feet from the old line. This new pipe was then connected into the line and the old pipe that it replaced was removed and cleaned, then laid in the new location and connected with the new line. Each time a section of the relocated line was put into service it was necessary to shut off the supply of water from the water plant.

(*Continued on page 16*)

ANNOUNCING!

NEW BULLETIN

Tells you all about the revolutionary Accelator for water softening. *What* it is. *How* it operates. *Why* it has so many advantages over any other method of lime or lime-soda water softening.

Write today for Bulletin 1820!

INTERNATIONAL FILTER CO.

59 E. Van Buren St.
Chicago, Ill.

(*Continued from page 15*)

In all, sixteen cut-ins were made and all at night. While the connection was being made, the city was dependent upon the 250,000 gallon tank. Making a connection required about six hours. The first cut-in required about twice that long and was not completed until about noon of the following day. This was the only instance when there was danger that the reserve tank be exhausted. The old main had an incrustation of 1 to 1½ inches. This was removed and the inside of the pipe was treated with pipe coating. The 50-year old main was restored to its original capacity and most of it was re-located and is now in use. H. J. Swain, an employee of the Columbus, Ohio water department, was employed to do the special work of making the connections. George S. Irwin, superintendent of the Delaware water department, was in charge of the project.

Two new reservoirs are in prospect for Cleveland, Ohio. The city is preparing to ask WPA to help build the long-proposed 40,000,000-gallon reservoir on city property in Warrensville, Ohio. Legislation has been introduced in the City Council which would authorize the WPA to build a 10,000,000-gallon reservoir for the city water division at Chardon

(*Continued on page 18*)

DIFCO

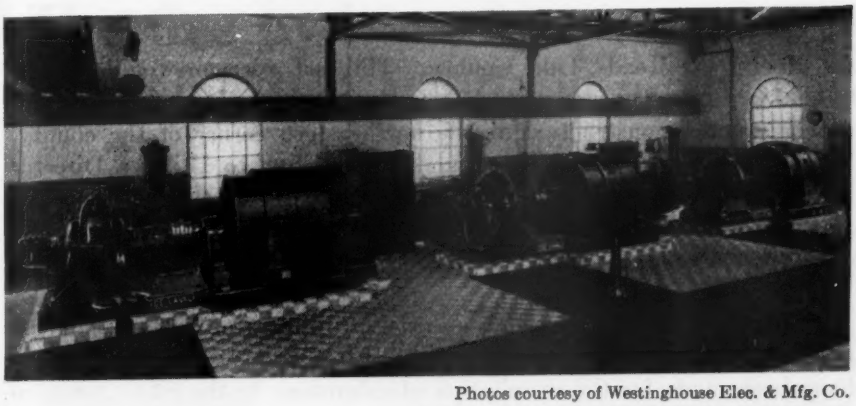
Certified Dyes for Culture Media

Certified by the Committee on Standardization of Biological Stains for use in the preparation of bacteriological culture media, this group of dyes meets the requirements of most rigid standardization and control.

Bacto-Eosin Y (DE-2)
Bacto-Methylene Blue (DA-2)
Bacto-Brilliant Green (DEg-1)
Bacto-Crystal Violet (DC-1)
Bacto-Basic Fuchsin (DF-4)

Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

DIFCO LABORATORIES
INCORPORATED
DETROIT, MICHIGAN



Photos courtesy of Westinghouse Elec. & Mfg. Co.

Better

WATER SUPPLY

for PHILADELPHIA

The new East Park Pumping Station at Philadelphia is designed to improve conditions in the downtown section, to meet excess hot weather demands for South Philadelphia, and to act as a standby for the Belmont Station.

3 DE LAVAL PUMPS

driven by synchronous motors have a capacity of 25 m.g.d. each against 149 ft. head, or 20 m.g.d. against 170 ft. Field tests showed over 85 per cent wire-to-water efficiency.

The Philadelphia Water Works System now has twenty De Laval pumping units of approximately 445 m.g.d. aggregate capacity, in raw water, domestic and wash water service, installed in the East Park, Torresdale, Shawmont, Roxborough, Lardner's Point, Chestnut Hill, Queen Lane and Belmont Pumping Stations. In addition, there are numerous De Laval pumps supplying hydraulic pressure, feeding boilers, circulating condenser water, etc.

DE LAVAL STEAM TURBINE COMPANY

Trenton, New Jersey

Manufacturers of Steam Turbines, Centrifugal Pumps, Propeller Pumps, Rotary Displacement Pumps, Centrifugal Blowers and Compressors, Worm Gears, Helical Gears, Hydraulic Turbines, Flexible Couplings. Sole Licensee of the Bauer-Wach Exhaust Turbine System. 4091

(*Continued from page 16*)

and Rockefeller Roads, Lake County. This last reservoir would be used to hold in reserve the water pumped by the Nottingham pumping station, which is under construction at the northeastern corner of the county. When the municipal plant is expanded, according to Utilities Director Frank O. Wallene, it will furnish electricity to the Nottingham station. Having the reservoir will enable the Nottingham station to pump chiefly during hours when the light plant has an off-peak load.

Work has been started on a major improvement program to increase the flow and pressure in the older sections of Brooklyn, and provisions have been made for the installation of extensions to the city's mains in recently developed areas. This is a project of the Works Progress Administration described in a report to Washington WPA headquarters by Lieut. Col. Brehon Somervell, Administrator of the New York City WPA.

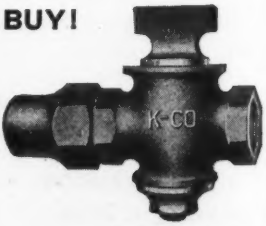
The improvements will cost $1,149,789, of which $538,825 will be reimbursed to the U.S. Treasury from the New York City capital outlay budget for materials. supplies and equipment necessary in laying and installing the twenty miles of cast-iron pipe. The project is scheduled to

(*Continued on page 20*)

SPECIFY "K-CO" WHEN YOU BUY!

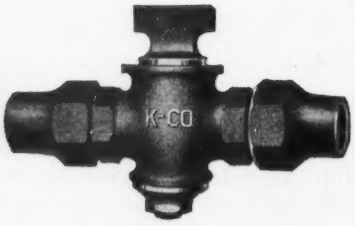
SOLID TEE HEAD ROUNDWAY COCKS

This trade mark guarantees a water works product made of finest quality metals, precision machined . . . tested for ease of operation and freedom from leakage.



C-161 Roundway Stop
Inlet Copper Pipe Coupling
Outlet for Iron Pipe

C-101 Roundway Stop
For Iron Pipe
Tee Handle



C-163 Roundway Stop
Copper Pipe Couplings Both Ends

C-103 Roundway
S. & W.
For Iron Pipe
Tee Handle

KITSON COMPANY

2409-15 Westmoreland St., Philadelphia, Pa.

Manufacturers of Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters . . . Quality Brass Goods for Gas, Water and All Plumbing Uses.

The fire hydrant for present-day service and traffic conditions

THE Kennedy SAFETOP meets every requirement of strength, safety and economy as well as instant readiness and reliability in service.

It is strong enough to resist any ordinary impact; but if broken by a collision which *no* hydrant could resist, it is speedily and economically returned to service, without excavation or shutting off the water supply.

Its easy elbow and nozzle curves and its extra-large standpipe assure minimum pressure loss; and its simple, straight-line operating mechanism assures positive operation without danger of sticking.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY SAFETOP FIRE HYDRANT

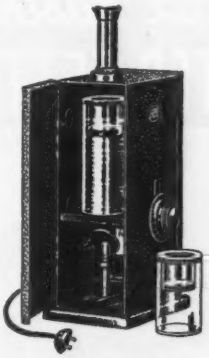
REG. U.S. PAT. OFF.

OVER 500 municipalities use American or New York Continental Jewell Water purification equipment.

WATER FILTERS
WATER SOFTENERS

Proportionate Electro-Magnetic Chemical feeders for feeding lime, acid, alum, soda ash, etc.

AMERICAN WATER SOFTENER COMPANY
Lehigh Avenue and 4th St.
Philadelphia, Pa.



HELLIGE TURBIDIMETER

Recent improvements greatly increase the convenience of operation—an accurate test can be made in a minute. Reads turbidities down to zero.

HELLIGE, INC.
3718 NORTHERN BLVD.
LONG ISLAND CITY, N. Y.

(*Continued from page 18*)

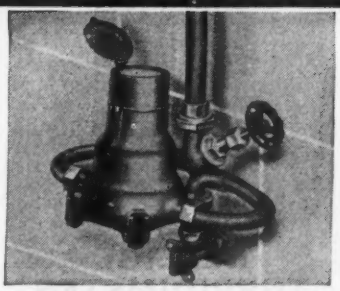
be completed within a year's time. The program will give employment to about 800 men who have been doing similar work in rehabilitating the borough's water distribution system through the WPA.

Work is in progress between Fulton Street and Lafayette Avenue, preparatory to the removal and replacement of 330 feet of the old 30-inch water main to avoid a recurrence of flooding the downtown sections through water main breaks. During last March a break in the water main between Lafayette Avenue and Hanson Place flooded the downtown district, undermining buildings and causing other related damages. About 560 feet of new 30-inch cast-iron pipe, installed by engineers of the WPA, has replaced the old broken section of the main.

The major phase of the work consists of laying and installing approximately 30,000 feet of 12-inch and 22,810 feet of 20-inch water mains. Engineers in charge of the project expect to lay an average of 10,000 feet of cast-iron pipe per month, depending upon weather conditions. In some parts of the older developed districts, the hole bores of the original 6-inch pipe, laid between sixty-five and seventy years ago, have been found to be but three and one-half inches, due to the accumulation of rust and

(*Continued on page 22*)

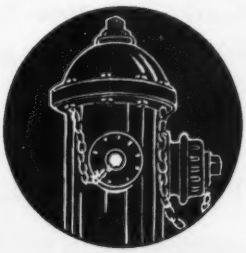
Correct Basement
METER SETTING



Shown here is a meter setting with a Ford Angle Valve and a Ford Valve COPPERHORN. The compression valve in the COPPERHORN is convenient for shutting off back water or for customer use in repairing faucets. Let us tell you more about modern meter settings.

The Ford Meter Box Co.
WABASH, INDIANA

Kupferle pioneered in the making of fire hydrants—and has stayed at the head of the procession ever since.



Two distinct styles for public and private installations—six different sizes, complying with the specifications of the American Water Works Association.

Specification sheets sent on request

John C. Kupferle
Foundry Co. St. Louis

KUPFERLE
FIRE HYDRANTS

HERSEY

The Four Aces *in the* Water Works Field

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK PORTLAND, ORE. PHILADELPHIA ATLANTA DALLAS CHICAGO SAN FRANCISCO LOS ANGELES

(*Continued from page 20*)

other obstructing materials. Sections of the old distribution system are to be replaced with 8-inch cast-iron pipe to take care of increasing demands for high pressure water supply by industrial and domestic consumers, as well as for use in modern fire fighting.

Formerly 500 gallons per minute from a single hydrant were sufficient for fire fighting apparatus, but modern equipment calls for 750 to 1,000 gallons of water per minute. This requirement has also brought further demands for larger and better designed hydrants than those now in service in areas where the pressure is below par. Also, with greater consumption of water for personal hygiene, recreation and the many social advances and scientific developments made since the turn of the century, the older water main installations have been declared to be inadequate.

Included among the older residential sections suffering from the lack of sufficient water pressure, is the Borough Park neighborhood. Here the bore holes have been found to be only two inches. Borough Park was formerly serviced with water by the privately operated Blythebourne Water Works. Twenty years ago the city took over the old water works and later the sum of $87,000 was reported paid to the proprietors.

(*Continued on page 26*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2" to 84"

Flanged Pipe *Flexible Joint Pipe*

Bell and Spigot Pipe

Special Castings *Short Body B. & S. Specials*

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

MORRIS KNOWLES, INC.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.
Pittsburgh, Pa.

METCALF & EDDY
Engineers
Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories — **Boston, Mass.** — **Statler Building**
Valuations — **Harrisburg, Pa.** — **Telegraph Building**

REEVES NEWSOM
Engineer - Consultant
Supply, Purification and Distribution of Water
Operation **Design** **Construction**
Valuation **Rates** **Negotiations**
Investigations **Taxes** **Accounting**
500 Fifth Avenue New York City

PEASE LABORATORIES, INC.
39 West 38th Street, New York
Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.
Chemists Field Sanitary Surveys
Bacteriologists Consultants

MALCOLM PIRNIE
Engineer
Water Supply, Treatment, Sewerage, Reports, Plans, Estimates, Supervision and Operation Valuation and Rates.
25 W. 43rd St., New York, N. Y.

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings
50 Church St. New York City

ALEXANDER POTTER
Consulting Engineer
Specialties: Water Supply and Sewerage
50 Church St. New York City
Telephone 5501 Cortlandt

CLYDE POTTS
M. Am. Soc. C. E.
Consulting Sanitary Engineer
30 Church Street - - New York
Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

SCOFIELD ENGINEERING CO.
Consulting Engineers
Water, Gas, Electric Plants and Distribution Systems
Appraisals, Valuations and Reports
Design—Supervision—Operation
Philadelphia, Penna.

WESTON & SAMPSON
Robert Spurr Weston **G. A. Sampson**
Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes. Operation of Purification Plants and Sanitary Analysis.
14 Beacon St. Boston, Mass.

WHITMAN, REQUARDT AND SMITH, *Engineers*
EZRA B. WHITMAN — NORMAN D. KENNEY
GUSTAV J. REQUARDT — ROBERT T. REGESTER
BENJAMIN L. SMITH — THEODORE W. HACKER
WATER WORKS - SEWERAGE - UTILITIES
Baltimore, Md. Albany, N. Y.

Help Build up Your Association by Bringing in a New Member
SEND FOR APPLICATION BLANK
AMERICAN WATER WORKS ASSOCIATION
22 East 40th St. NEW YORK CITY

(*Continued from page 22*)

During the building progress in this area, many of the old valves on the Blythebourne system were covered with asphalt pavement, thus presenting a problem to the Department of Water Supply when repairs or adjustments had to be made in this locality. The work to be done by WPA engineers involves the transferring of approximately 1,500 house services now on the Blythebourne line to the city mains. In addition, it is necessary on streets exceeding 40 feet in width to connect the Blythbourne mains, which are of larger diameter, to the existing city mains. The house connections on the larger Blythebourne mains will remain in service, thus saving the taxpayers considerable money.

New water works have been voted by many Wisconsin towns. Town leaders have worked to develop projects, obtain surveys, and apply for federal grants. Fredonia had the largest vote turnout in its history to approve the building of water works and a sewage disposal plant. As in the great majority of water works now under construction, a federal grant will pay 45 per cent and Fredonia will float bonds to meet the remainder of the $80,000.

(*Continued on page 28*)

PLAY SAFE!

Ludlow Hydrants are always ready for action—easy to maintain—easily repaired when broken off. They drain from the bottom to eliminate freezing; break only above ground; offer no obstruction to flow of water; prevent water hammer. And they are attractively modern. Send for free catalog.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

It makes NO difference to

% PROPORTIONEERS %

"Perchloron"
"HTH"
"Columbia"
"Wil-Chlor"
"Maxochlor"
"Purex"
"Chlorofectant"
"Chlorox"
"Isco"
"Kohnstamm"
"Clor-O-Mor"

Accurately fed by Chlor-O-Feeders, **these chemicals have all been proved practical in chlorinating medium and small water and sewage plants; and even to sterilize big plants in emergencies.**

% PROPORTIONEERS, Inc. %
18 Codding St., Providence, R.I.

A. W. W. A.
59th Convention

Atlantic City
June 11-15, 1939

Housing Headquarters

Hotels
Ambassador and Chelsea

Single rooms	20	at	$2.50*
	75	at	3.00
	30	at	4.00
	60	at	5.00
	10	at	6.00
Double rooms	10	at	4.00*
	40	at	5.00
	260	at	6.00
	240	at	7.00
	115	at	8.00
	25	at	10.00
Suites	80	from	12.00
		to	20.00

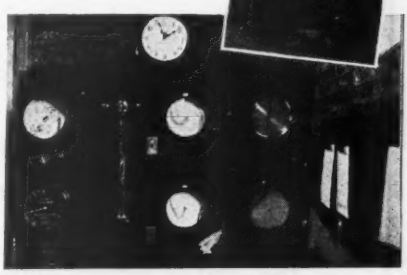
*Lowest priced rooms are without bath.

Make Your Reservations Now

FLOW AND LEVEL METERS FOR THE COMMUNITY PLANT

WESTCHESTER, N. Y.
Panel mounted Type M Venturi Register—Indicator—Recorder at Rye Lake Pumping Station.

NEW ROCHELLE, N. Y.
Chronoflo Transmitters in the Metz Reservoir Gate House transmit water level to distant Chronoflo Recorders. Venturi Meter measures flow.



Experienced engineers and superintendents of small, large, and medium size plants choose Builders Venturi and Chronoflo Meters and Controllers to aid in maintaining initial efficiency and in keeping down cost of operation.

Bulletin 298 shows many new applications of Chronoflo Meters. Would you like it?

BUILDERS IRON FOUNDRY
"Builders of the Venturi Since 1891"
9 Codding St. Providence, R. I.

(*Continued from page 26*)

Pardeeville has voted a bond issue of $45,000 and Granton voted a $20,000 issue. Necedah has water works well under construction, and people in Pittsville voted to incorporate, then voted in favor of a water works referendum. Poynette voters have sanctioned a $45,000 bond issue for part of the cost of building water works. Coloma residents have incorporated toward the ultimate end of securing water works. Manawa is holding a special election to decide the fate of a proposed $112,000 water works system.

Ripon is considering buying the water works from the Wisconsin Power and Light Co. A PWA grant to finance improvements and extensions has been asked as a result of the proposed purchase. Edgar has begun work on its water works and sewer project. Orfordville has already turned water into its new water mains and is rushing work on its sewage disposal plant to complete the dual system. Lake Mills has received authorization from the public service commission of Madison to spend $17,000 on the improvement of its municipal plant. Burlington completed a new tank in August to replace the old one which collapsed July 19. Muscoda has received a $36,000 PWA grant to help in installing a water works.

(*Continued on page 30*)

CLEAN YOUR WATER MAINS

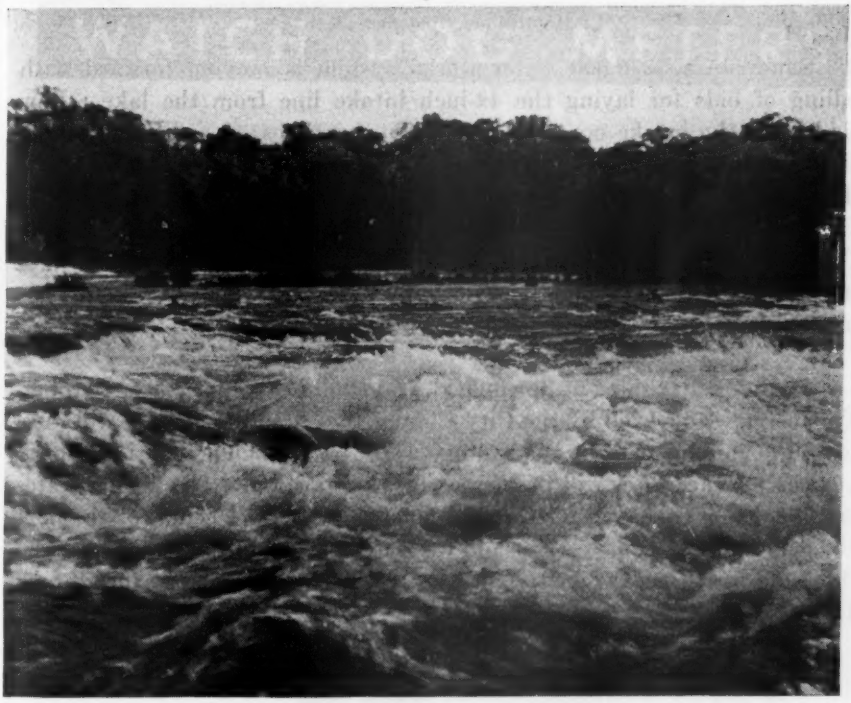
One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

50 Church St., New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.



"THE REMEMBRANCE OF QUALITY PERSISTS LONG AFTER THE PRICE IS FORGOTTEN"

This statement is particularly significant in the water purification field as it can truly be said that the consumers' consciousness of their water supply is only aroused by the poor quality of its tap water. The difference between a palatable and non palatable drinking water is the cost of a very few cents per year to each consumer.

AQUA NUCHAR does an effective "job" of removing taste and odors from water at such a low per capita cost that to-day little reason exists for tastes aud odors breaking through.

AQUA NUCHAR INSURES PALATABLE DRINKING WATER.

Industrial Chemical Sales Division

WEST VIRGINIA PULP & PAPER COMPANY

230 Park Avenue, New York, N. Y.

1322 Widener Building, Philadelphia, Pa. | **205 W. Wacker Drive, Chicago, Ill.** | **417 Schofield Bldg., Cleveland, Ohio**

Manufacturers of POWDERED ACTIVATED AQUA NUCHAR CARBON **Activated Carbon**

(*Continued from page 28*)

Sandusky's $820,000 water works system is moving forward with calling of bids for laying the 42-inch intake line from the lake. Low bidder for the intake contract is the Thacher Bros. Co., Toledo, whose bid was $195,901.70. The City Commission of Sandusky has hired J. H. Herron Co., Cleveland, to test and inspect all materials going into the new water works. The cost of testing materials for the entire job will be $3,000. The Commission has ordered legislation prepared for elimination of 10 cross connections between the city's water system and that of private concerns about the city to safeguard the purity of city water.

Higher water rates at Springfield, Ohio will be in effect after October. The increase approved by the City Commission is 50 per cent; it will raise to $3 the amount paid by the average water user which is now $2 each six months. Other rates will be increased in proportion. The present rates are 75 cents a thousand for the first 500,000 cu.ft., 67½ cents for the next 166,666 cu.ft., 60 cents a thousand for the next 333,334 cu.ft., 52½ cents a thousand for the next 333,333 cu.ft., and 45 cents a thousand for all over 1,333,333 cu.ft.

Expectation is that the increase in water rates will produce $80,000

(*Continued on page 32*)

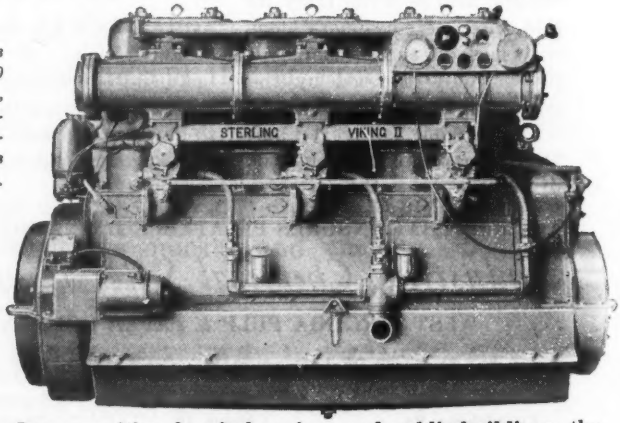
Recent Catastrophes

Along the Atlantic Seaboard, Floods in the Ohio and Mississippi Valleys Windstorms and Sleet, are not confined to any locality

What protection have you when your power is interrupted?

SPRINGFIELD, MASS.,

with a P.W.A. grant, is installing 10 Sterling 180 H.P. and 2 - 425 H.P., 1200 R.P.M. engines, directly connected to Warren centrifugal pumps for emergency pumping.



Sterling — The Engine Of Efficiency

In many cities, hospitals, mines and public buildings, the power supply is being guarded by Sterling Engines.

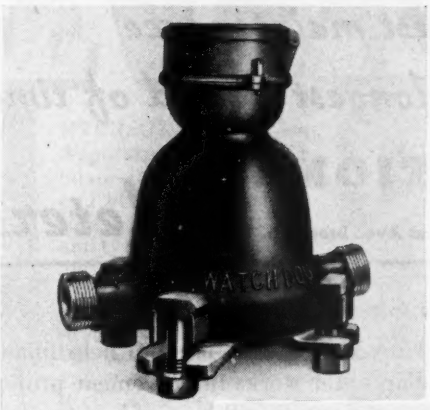
STERLING ENGINE COMPANY

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

Dept. C-3

Branch Office
900 Chrysler Bldg.
New York, N. Y.

WATCH DOG METERS



Turbine meter

Frost-proof meter

Investigate these meters

. . . more than 3,500,000 now in use

WHEN looking over your requirements, remember that thousands of municipalities are getting satisfactory low-cost service from Worthington-Gamon Meters.

WORTHINGTON-GAMON METER COMPANY

General Offices: HARRISON, NEW JERSEY

Offices and Representatives in Principal Cities

WORTHINGTON-GAMON

WG8-7

For maximum water revenue
with the lowest maintenance
for the longest period of time

Investigate **NATIONAL** *Meters*

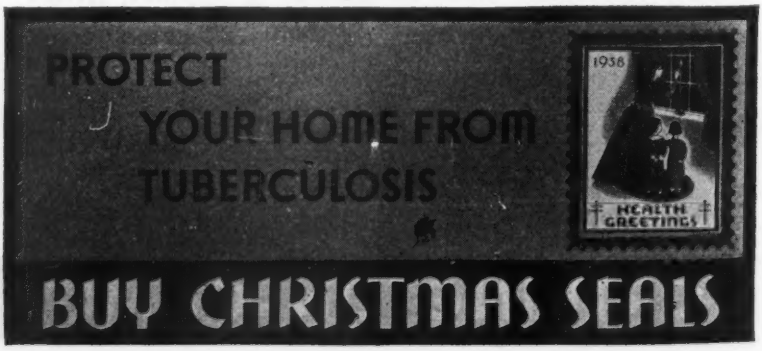
NATIONAL METER COMPANY, 4207 First Ave., Brooklyn, N. Y.

(*Continued from page 30*)

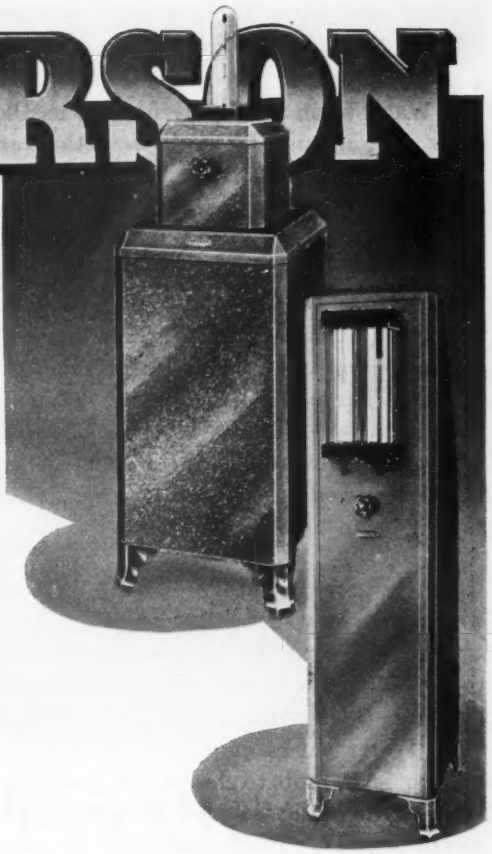
or more annually. The additional revenue will be used to help finance bonds to be issued for a million-dollar water works improvement project, though it is said that most of the extra revenue will be required to maintain and operate the proposed new filtration plant. Mandated by the Ohio Supreme Court, the proposed improvements include a filtration plant, low lift pumps and outside pumps, dam on Beaver Creek, if necessary, and a clear water reservoir. The city is seeking a federal grant of $491,210 to help carry out the program, estimated as high as $1,091,579.

Permission to abandon fire hydrants has been asked of the Public Utilities Commission by the Ohio Water Service Co. which serves Masillon. The city owed the water company $104,899 for hydrant rentals as of August 31 and this debt is increasing at the rate of $2,000 a month with no provision made to pay it. The company contends that inability of the city to pay its bills has embarrassed the company in meeting its obligations. Negotiations between the city council and the water company have failed because a group of councilmen has insisted that before any contract would be given the water company would have to promise to discontinue the use of Newman creek as a source of supply.

(*Coutinued on page 34*)



EVERSON



EVERSON Sterilizing Apparatus measures, mixes and feeds chlorine and other gases in solution. Proper capacities and types for waterworks and sewage use.

Gas flow is controlled with extreme accuracy by means of a single valve control; is measured in micro calibrations by a visible eye level Rota-Meter.

EVERSON Sterilizers are made automatically safe—gas flow is synchronized with "on" and "off" of water pump, is also protected by automatic shut-off in case of pressure failure, by an automatic vent syphon break that prevents back flooding.

All operation is under vacuum, is water sealed, all parts are easily accessible and parts contacting chlorine or chlorine solution are rubber, glass, silver or tantalum.

Having large capacity range to meet any requirement, this new modern equipment comes with a choice in attractive cabinets.

Write for Special Bulletins and Prices

EVERSON MANUFACTURING CO.

221 WEST HURON STREET, CHICAGO, U. S. A.

New York City, N.Y. Detroit, Mich. Dallas, Texas Nashville, Tenn. Amarilla, Texas Moline, Illinois
Boston, Mass. Pittsburgh, Pa. Houston Texas Miami, Florida Wichita, Kansas Missoula, Mont.
St. Louis, Mo. St. Paul, Minn. Oklahoma City, Okla. Dayton, Ohio San Antonio, Texas Worthington, Ind.

(*Continued from page 32*)

Water main testing by firemen has been staged at Jackson, Mich. to show the advantages and protection afforded by large water mains. Fire Chief Ernest C. Daunter demonstrated that a 4-inch main was not sufficient to furnish enough water to protect an industry. A centrifugal pump was attached to a 4-inch main and a pump rate of 508 gallons per minute was attained. The main was unable to furnish more water. This pump rate, it was pointed out, usually would be adequate for residence fires but not for an industry which might locate in the district. A positive action, piston-type pump was attached to a 12-inch main with different results. The pump, capable of 1,200 gallons per minute, pumped nearly 1,000 gallons per minute through a ladder wagon's turntable hose "gun." The stream of water shot nearly 200 feet in the air. Chief Daunter ended the demonstration advocating that nothing smaller than 6-inch mains should be installed.

A 12-inch line broke in Ashtabula, Ohio and a large part of the city was without water for more than six hours. Heavy September rains had softened the earth fill, allowed the fill to settle and a brace upon an elbow to give way, all of which permitted the joint to open. This elbow was in a low pressure line that supplies the southern section of the city.

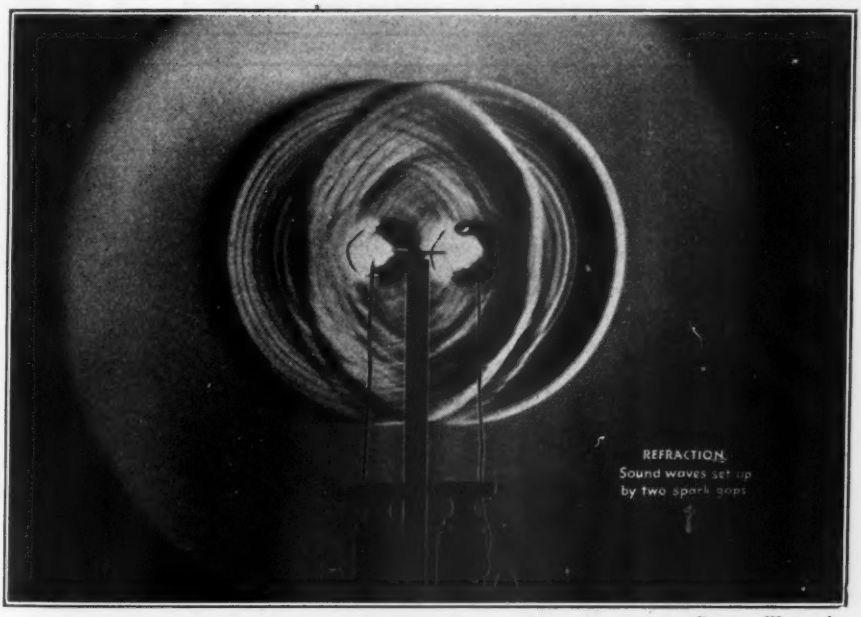
"Water works employees hurried to the break and began to close valves. Attempts to close a valve near the break failed for the stem broke, this in spite of the fact that all valves in the city had been inspected within recent months. While homes and restaurants conserved the small amount of water they were able to procure when the pressure started to drop, or drained water from faucets in cellars and used extra supplies of milk for drinking purposes, a large emergency crew was able to repair the break and allow normal service again in a little more than six hours."

So reads the local newspaper account. Water works men of long experience will recognize that the breaking of a valve stem under such conditions is not necessarily evidence that the valve is defective. The high velocity set up by a water main break must be controlled by cramping down slowly on a series of valves rather than by attempting to close off the entire flow at one operation. This element of needed care is often overlooked or unknown to the men who are sent out in such an emergency and much damage can result from failure to take proper protective action.

A supplementary grant of $2,897,803 has been given by PWA to Toledo for the Lake Erie water supply system. This brings the total of federal funds available for the project to $4,591,803.

(*Continued on page 38*)

It's there—even tho' you can't see it!



Courtesy Electronics

—like Trident Meter QUALITY...

FROST PROOF

The human eye can't see the sound waves caught by the ultra-speed camera. Neither may you be able to perceive the greater Quality in Trident precision-built Water Meters . . . until our super-sensitive gauges reveal their finer finish, closer tolerances and higher standards of precision achieved by modern shop equipment. But you *will* readily see it in their closer range and higher percentage of accuracy, perfect interchangeability, longer wear, lower maintenance costs. Six million *plus* Neptune-built water meters used, the world over.

TRIDENT

Neptune Meter Company, 50 West 50th St. (Rockefeller Center), New York City; Neptune Meters, Ltd., 345 Sorauren Ave., Toronto, Canada. Branch Offices in Principal Cities of the United States.

PRECISION-BUILT WATER METERS

MABBS

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

A. W. W. A. Membership Certificate

Give us your name—exactly as you wish it to appear. Send 40¢ in coins or postage to cover cost of lettering and mailing, and you will receive a fine newly designed parchment paper membership certificate, 9 by 12 inches in size, ready for framing.

(*Continued from page vi*)

Reinstatements

AMEND, J. E. 61 South 6th St., Brighton, Colo.
SHELDON, HORACE A. Commissioner, Port Jervis, N. Y.

Resignations

BODKIN, J. T. St. Joseph Water Co., St. Joseph, Mo.

Deaths

ROWE, JAMES C. Filter Operator, Saratoga Springs Water Co., 81 Lake St., Saratoga Springs, N. Y.
RUDDEROW, MAURICE B. Mgr., Merchantville-Pennsauken Water Co., 13 West Maple Ave., Merchantville, N. J.

Transfers between Sections

GAIL P. EDWARDS, from New England to New York.
EDWARD R. STAPLEY, from Southwest to New England.
L. T. REINICKER, from Four States to New Jersey.
W. W. MATHEWS, from Missouri Valley to Wisconsin.

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.
Lawrenceburg — Indiana

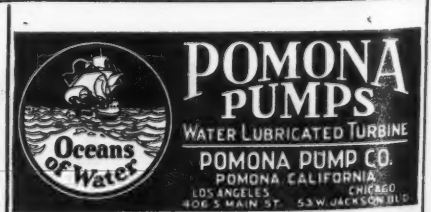
WELL SCREENS

To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.
2304 Long Avenue,
St. Paul, Minn.

SAVE 80% ON YOUR TRENCHING COSTS WITH A
GIANT PIPE PUSHER

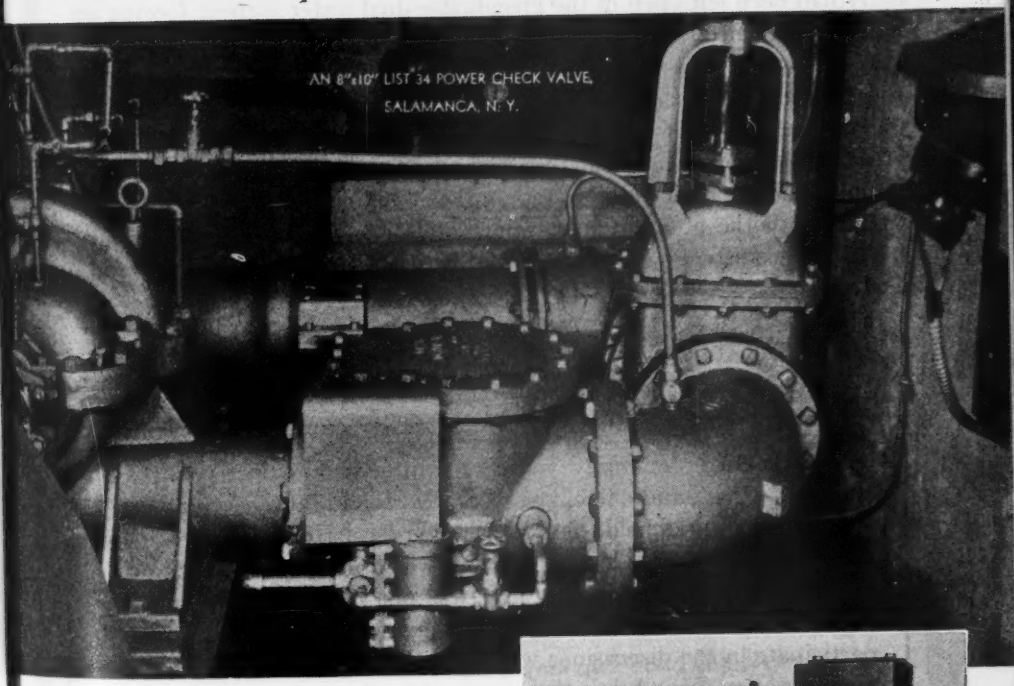
10 DIFFERENT SIZES
TO FILL EVERY NEED
WRITE FOR CATALOG
Dept. P-3
GIANT MFG. CO.
Council Bluffs, Iowa



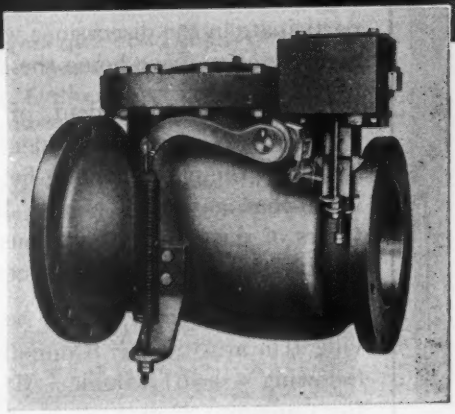
FOR QUIET CLOSURE & MAXIMUM EFFICIENCY—INSTALL

RENSSELAER

LIST 34 POWER CHECK VALVES



AN 8"x10" LIST 34 POWER CHECK VALVE,
SALAMANCA, N. Y.



ositively eliminates slam on pump
hut-down.

ull clearway opening reduces head
oss and cuts power costs.

implicity of design and rugged
onstruction results in trouble-free
peration over a period of years.

Bulletin "V" mailed on request

RENSSELAER VALVE COMPANY, TROY, N. Y.

(*Continued from page 34*)

Faulty connection in a greenhouse caused pollution in a part of Detroit's water supply recently. Householders in part of the city were urged to boil drinking water while Board of Health and Dept. of Water Supply officials satisfied themselves that the mains had been cleansed of all impurities.

Pollution of the water was traced to a nursery where a valve apparently had been left open in the greenhouse dual water system, forcing animal fertilizer into the water mains. Over 500 families in the section were affected by the boil-water order. No illness traceable to pollution from the connection was reported. The owner of the nursery promised immediate correction of the plumbing and full cooperation with the Board of Health. Laurence G. Lenhardt, general manager of the Dept. of Water Supply, said the dual water system in the greenhouse probably was a violation of both the plumbing code and regulations of the Board of Health, but that the system had been installed before the territory was annexed to Detroit.

Patrick Gear, for many years superintendent of water works at Holyoke, Mass., and one of the most colorful and interesting persons in the water works field, died on October 24. He had been a member of this association since 1913 and was a member of its Board of Directors from 1924 to 1928. He was one of the most regular attendants at annual conventions and could be depended upon to participate in the discussions with such a combination of humor and sagacity as to drive home the observations he made.

L. M. Booth, President of the Booth Chemical Company of Elizabeth, N. J., died suddenly on November 6. He was widely known in the paper-making field and among water purification men. More than any other person, Booth had made the paper manufacturers of the country conscious of the vital part that water supply quality played in paper production.

Charles D. Brown, former secretary and manager of the Walkerville (Ontario) Water Company, died at his home on October 18, following a heart attack. Mr. Brown was a charter member of the Canadian Section of the A. W. W. A. and highly respected by all who knew him.

The LOCK JOINT "Book of Experience"

Through a Florida Cypress Swamp

Through a Florida Cypress Swamp

AT ST. PETERSBURG, FLA., Charleston, S. C., and Denver, Colo., adaptability to wet laying conditions meant positive savings in pipe line cost.

The joints of Lock Joint Pipe permit quick and effective sealing after laying, even in a very wet trench, thereby minimizing costly sheeting and dewatering. Furthermore, these tight, permanent, and flexible joints guarantee a pipe line free of troublesome leaks.

The use of Lock Joint Reinforced Concrete Pressure Pipe for your next pipe line will insure economy in installation and minimum maintenance costs.

LOCK JOINT PIPE CO., Ampere, New Jersey
PRESSURE : SUBAQUEOUS : SEWER : CULVERT

LOCK JOINT Reinforced CONCRETE PRESSURE PIPE

AMERICAN WATER WORKS ASSOCIATION

Headquarters Office

→→ 22 East 40th St., New York ←←

Officers

President	REEVES NEWSOM Engineer-Consultant, 500 Fifth Avenue New York, N. Y
Treasurer	WILLIAM W. BRUSH
Secretary	HARRY E. JORDAN
Assistant Secretary	P. S. WILSON

Board of Directors

Representing the Local Sections

California Section	NELSON A. ECKART, San Francisco, Cal.	to-1939
Canadian Section	ALBERT E. BERRY, Toronto, Ont.	-1940
Florida Section	A. P. BLACK, Gainesville, Fla.	-1939
Four States Section	CHARLES H. BECKER, Philadelphia, Pa.	-1939
Illinois Section	HAROLD E. BABBITT, Urbana, Ill.	-1939
Indiana Section	H. A. DILL, Richmond, Ind.	-1940
Kentucky-Tennessee Sect.	E. E. JACOBSON, Lexington, Ky.	-1941
Michigan Section	GEORGE H. FENKELL, Detroit, Mich.	-1941
Minnesota Section	LEONARD N. THOMPSON, St. Paul, Minn.	-1939
Missouri Valley Section	EARLE L. WATERMAN, Iowa City, Iowa	-1941
Montana Section	JOSEPH M. SCHMIT, Lewistown, Mont.	-1939
New England Section	ROGER W. ESTY, Danvers, Mass.	-1941
New Jersey Section	SAMUEL F. NEWKIRK, Elizabeth, N. J.	-1941
New York Section	WILLIAM A. MCCAFFREY, Oswego, N. Y.	-1941
North Carolina Section	PAUL W. FRISK, Enka, N. C.	-1940
Ohio Section	WALLACE W. MOREHOUSE, Dayton, Ohio	-1939
Pacific Northwest Sect.	MILTON H. MCGUIRE, McMinnville, Oregon	-1941
Rocky Mountain Section	CHESTER A. TRUMAN, Colo. Sprgs., Colo.	-1940
Southeastern Section	J. K. MARQUIS, Spartanburg, S. C.	-1940
Southwest Section	JOHN B. WINDER, Dallas, Texas.	-1939
Virginia Section	MARSDEN C. SMITH, Richmond, Va.	-1940
Western Penna. Section	H. LLOYD NELSON, Philadelphia, Penna.	-1941
West Virgina Section	MENTOR HETZER, Moundsville, W. Va.	-1940
Wisconsin Section	ARTHUR H. MILLER, Sheboygan, Wis.	-1940

Representing the Water Works Manufacturers Association

Manufacturer	DENIS F. O'BRIEN, East Orange, N. J.	-1939
Manufacturer	WILLARD T. CHEVALIER, New York, N. Y.	-1940
Manufacturer	CLINTON INGLEE, New York, N. Y.	-1941

Ex-Officio Members of the Board

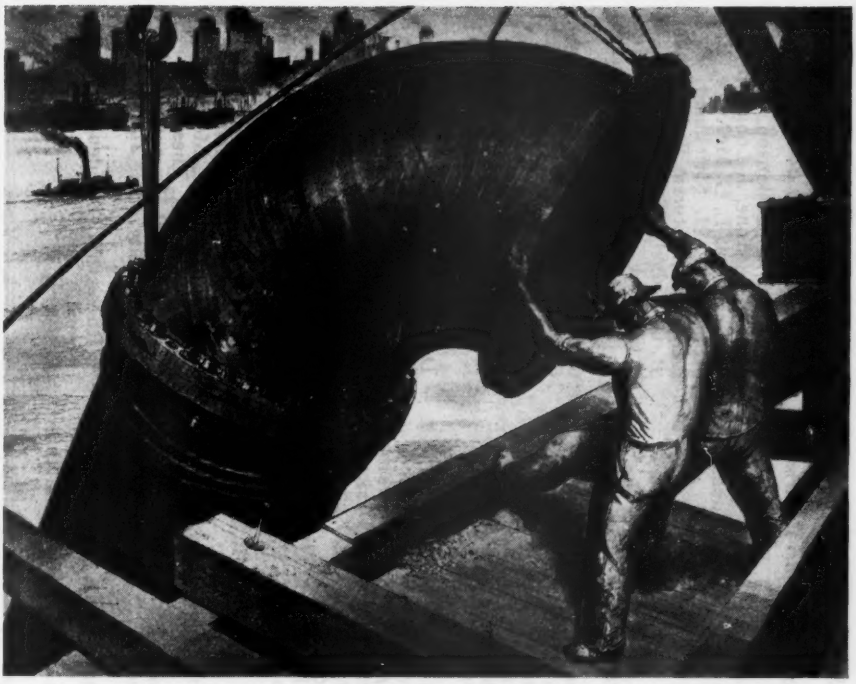
President	REEVES NEWSOM, New York, N. Y.	-1940
Past President	EUGENE F. DUGGER, Newport News, Va.	-1939
Treasurer	WILLIAM W. BRUSH, New York, N. Y.	-1939
Ch.W.W. Practice Comm.	MALCOLM PIRNIE, New York, N. Y.	-1939
Ch. Publication Comm.	LINN H. ENSLOW, New York, N. Y.	-1939

Officers of the Divisions

Finance and Accounting Division.—Chairman, M. F. HOFFMAN; Vice-Chairman, DALE L. MAFFITT; Secretary-Treasurer, WILLIAM J. SCHWARTZ; Directors, JACOB SCHWARTZ, HAL F. SMITH.

Plant Management and Operation Division.—Chairman, THOMAS L. AMISS; Vice-Chairman, A. P. KURANZ; Secretary-Treasurer, D. D. GROSS; Directors, SAMUEL F. NEWKIRK, L. S. VANCE.

Water Purification Division.—Chairman, CHARLES GILMAN HYDE; Vice-Chairman, CHARLES H. SPAULDING; Secretary-Treasurer, CHARLES R. COX; Past Chairman, WILLIAM M. WALLACE; Additional members of Executive Committee, M. C. SMITH, PAUL WEIR.



Lithographed on stone by James E. Allen for U. S. Pipe & Foundry Co.
Copyright, 1938, U. S. Pipe & Foundry Co.

IN a world of change and uncertainty, cast iron pipe remains steadfast—a material you can bank on—basically the same today as for two centuries—yet more than ever the accepted standard for underground mains. Cast iron pipe is the product of a progressive industry which has attained high standards and uniformity in metallurgy and manufacture—well exemplified by U. S. Super-de Lavaud Pipe, centrifugally cast in a metal mold *without chill.*

UNITED STATES PIPE & FOUNDRY CO., BURLINGTON, NEW JERSEY

Foundries and Sales Offices throughout the U. S. A.

Makers of U. S. Super-de Lavaud Centrifugally Cast Pipe and U. S. Pit Cast Pipe

U. S. CAST IRON PIPE

Officers of the Sections

Section	*Chairman*	*Vice-Chairman*	*Secretary-Treasurer*	*Past-Chairman*	*Other Members of the Section Governing Board*[1]
California	H. Reinhardt	F. S. Porter	B. S. Grant	J. E. Phillips	J. Barker, C. Hoskinson, M. Jones, B. Livingstone, J. Longwell
Canadian	A. B. Manson	—	A. E. Berry	E. V. Buchanan	C. E. Brown, L. G. McNeice, R. J. Smith, G. H. Strickland, F. G. Browne, W. Storrie, W. T. Randall.
Florida	T. M.Lowe	G. F. Catlett	J. R. Hoy	D. S. Wallace	R. G. Ridgely, G. Kingsley, K. R. Chinn, F. R. Mills, W. B. Gibson
Four States	C. J. Lauter	I. M. Glace	C. A. Hechmer	H. M. Freeburn	E. Hopkins, G. Wirtz, R. Beckett, J. DeGroot.
Illinois	W. D. Gerber	F. G. Gordon	C. W. Klassen	F. C. Amsbary	G. B. Prindle, H. H. Gerstein.
Indiana	P. C. Laux	M. H. Schwartz	J. A. Bruhn	J. L. Ford	C. L. Link.
Kentucky-Tenn.	C. M. McCord	H. Arnold	H. D. Schmidt	E. E. Jacobson	H. C. Bristol, H. N. Jernigan.
Michigan	C. R. Bird	R. J. LaMarre	M. N. Gerardy	E. E. Norman	R. Faust, H. Caswell.
Minnesota	J. A. Jensen	E. M. Grime	R. M. Finch	F. Seligman	A. Janzig, C. Elliott, U. Seibert.
Missouri Valley	B. L. Ulrich	J. C. Detweiler	E. L. Waterman	D. L. Maffitt	J. Dean, T. Filipi, E. Hopkins, E. Mathews, C. Patchen.
Montana	G. E. Atkinson	C. W. Eyer	H. B. Foote	R. N. Arnold	D. S. Thomas, Kurt Wiel
New England	S. S. Anthony	F. A. Marston	S. M. Ellsworth	W. J. Scott	H. W. Griswold, P. A. Shaw.
New Jersey	W. R. Conard	G. F. Wieghardt	H. N. Lendall	S. F. Newkirk	J. A. Carr, C. H. Capen.
New York	E. L. H. Meyer	F. Henshaw	R. K. Blanchard	A. D. Drake	C. R. Cox, E. K. Wilson.
North Carolina	W. M. Piatt	D. S. Abell	A. R. Hollett	J. W. Kellogg	G. Moore, A. True.
Ohio	W. R. LaDue	W. C. Lawrence	T. R. Lathrop	—	C. Inman, P. Burgess, M. Hoffman.
Pacif. Northwest	N. A. Gilman	T. H. Judd	F. Merryfield	M. H. McGuire	R. E. Koon, M. K. Snyder
Rocky Mountain	L. O. Williams	—	B. V. Howe	O. J. Ripple	B. Coy, J. Soderstrum, K. Darling, R. Streeter, E. Bradner, C. Riddell.
Southeastern	C. P. Townsend	P. Weir	B. P. Rice	D. R. Pringle	F. G. Crow, M. G. Stewart, J. H. McLure, H. F. Wiedeman
Southwest	A. R. Davis	M. B. Cunningham	L. A. Quigley	T. L. Amiss	A. Brenneke, W. McMurry, J. Montgomery, A. Theard.
Virginia	H. A. Johnson	W. G. Myers	H. W. Snidow[2]	H. B. Rice	E. Meredith,[2] R. Leveque.
Western Penna.	C. H. Young	E. A. Johnson	E. P. Johnson	E. C. Trax	J. Dunwoody, M. Mansfield, A. Martin
West Virginia	T. L. Young	W. Kirchman	J. B. Harrington	A. R. Todd	A. Rhoads, H. Speiden, G. Underwood.
Wisconsin	W. C. Staeffler	A. E. Hintz	L. A. Smith	W. U. Gallaher	J. Myers

[1] For Section's representative on the A. W. W. A. Board of Directors, see list on page ii
[2] Virginia Section—Secretary is H. W. Snidow; Treasurer E. C. Meredith

COMING MEETINGS

December 29—New York Section, at Hotel Pennsylvania, New York, N. Y. Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

January 16-20—Oklahoma Water & Sewage Conference and Short Course, at A. & M. College, Stillwater, Okla. Secretary of Conf., H. J. Darcey, State Board of Health, Oklahoma City, Okla. Director of Short Course, C. E. Perkins, A. & M. College, Stillwater, Okla.

February 7—New Jersey Section, at New Brunswick, N. J. Secretary, H. N. Lendall, Rutgers University, New Brunswick, N. J.

April 10-12—Kentucky-Tennessee Section, at Memphis, Tenn. Secretary, H. D. Schmidt, State Dept. of Health, Nashville, Tenn.

April 12-14—Canadian Section, at Royal York Hotel, Toronto, Ont. Secretary, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

April 17-19—Southeastern Section, location not yet announced. Secretary, B. P. Rice, 422 State Office Building, Columbia, S. C.

April 25-26—Indiana Section, at Indianapolis, Ind. Secretary, J. A. Bruhn, Box 855, Indianapolis, Ind.

April 27-28—Ohio Section, at Dayton, Ohio. Secretary T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

May 18-20—Pacific Northwest Section, at Tacoma, Wash. Secretary, Fred Merryfield, Oregon State College, Corvallis, Ore.

***June 11-15*—American Water Works Association Annual Convention, at Atlantic City, N. J.**

See page 16 (advertising section) for hotels and rates.

October 16-19—Southwest Section, at Dallas, Texas. Secretary, L. A. Quigley, Supt., City Water Works, Fort Worth, Texas.

CHANGES IN MEMBERSHIP

New Members, Applications Received Oct. 1 to 31, 1938

Active

ARNOLD, VICTOR E. Pres., Phoenix Meter Corp., Prince Bay, Staten Island, New York.

BAUER, JOSEPH P. Sanitary Inspector, Bureau of Water Works & Supply, Box 240 Arcade Annex, Los Angeles, Calif.

BURNS, ROSS J. Sales Representative, Badger Meter Co., 1213 Buckingham St., Sandusky, Ohio.

CAMPBELL, JOSEPH D. Supt., Merchantville-Pennsauken Water Comm., 13 West Maple Ave., Merchantville, N. J.

CHILSON, FRANK H. Asst. City Engineer, City of El Segundo, 209 W. Franklin Ave., El Segundo, Calif.

COLLAR, IRA T., JR. Dist. Mgr., Neptune Meter Co., 2107 Grand Ave., Kansas City, Mo.

COLLINS, WM. E. Acting Supt., Borough of Collingswood, 713 Lees Avenue, Collingswood, N. J.

CORNELL, GUY B. Water Works Engineer, Fresno City Water Dept., 1926 Tuolumne St., P. O. Box 1275, Fresno, Calif.

COSTELLO, JAMES W. Chief Engr., Dept. of Public Affairs, City Hall, Newark, N. J.

DAVENPORT, JULIUS H. Civil Engr., Route 1, Box 537, Long Beach, Calif.

DIEHL, PAUL A. Chemist, Black & Veatch, 4706 Broadway, Kansas City, Mo.

DUHME, RALPH E. Asst. Supt. Supply Division, 5932 Pandora Ave., Pleasant Ridge, Cincinnati, Ohio.

FUGATE, G. L. Chief Engr., City of Houston Water Dept., 631 Harvard St., Houston, Tex.

GOLDSWORTHY, C. M. Auditor, California Water & Tel. Co., 601 Lighthouse Ave., Pacific Grove, Calif.

GRAHAM, WM. H. Supt., Boro of Verona, Municipal Bldg., Verona, N. J.

GREENWOOD, PAUL. Chief Engr., Water Works, Moorestown, N. J.

HARLAND, ROBERT O. Accountant, Fresno City Water Dept., P. O. Box 1274, Fresno City, Calif.

HENLEY, THOMAS B. 1410 Baldwin Ave., P. O. Box 101, Rosemead, Calif.

HOVEY, VICTOR M. Supt., Municipal Water Co., Oskaloosa, Iowa.

IMBLEAU, TREFF. Chief Engr., Provincial Paper, Ltd., Thorold, Ont., Canada.

IRWIN, WM. F. Sales Repr., Louisville Cement Co., 2538 Hackberry Street, Cincinnati, Ohio.

LEAVITT, WILLIAM F. Gen. Foreman, Fresno City Water Dept., 1926 Tuolumne St., Fresno City, Calif.

LYON, LAWRENCE H. Supt., California Water & Tel. Co., 601 Lighthouse Ave., Pacific Grove, Calif.

MACLEOD, MYRON. The American City Magazine, 470-4th Ave., New York, N. Y.

MARTIN, PAUL H. Sales Repr., Neptune Meter Co., 528 Hilltonia Avenue, Columbus, Ohio.

MCMANUS, JOHN P. Operator, Public Service Co. of No. Ill., Pontiac, Ill.

PATE, CARL L. Chief Chemist, % Treat-Rite Chemical Co., P. O. Box 276, Nowata, Okla.

PATTERSON, J. W. Div. Mgr., Northeastern Water & Elec. Service Corp., Water Street, Skowhegan, Me.

RAMACHER, BISMARK E. Meter Tester, Fresno City Water Dept., 1926 Tuolumne St., Fresno, Calif.

REECE, HOWELL. Mech. Design Engr., Water Department, City of Chicago, Chicago, Ill.

REHMANN, E. J. Resident Engr., 12th Street, Hammonton, N. J.

REID, JOSEPH Y. L. Supt. of Filtration, Trenton Water Dept., 535 Parkway Ave., Trenton, N. J.

SAHND, WILLIAM. Water Service Supervisor, Water Works Dept., Room 140½, City Hall, Cincinnati, Ohio.

SCHANZE, C. E. Supt., Monmouth Consolidated Water Co., 1014 Main Street, Asbury Park, N. J.

SCOTT, R. D. Chief Chemist, Ohio Dept. of Health, 1650 Essex Road, Columbus, Ohio.

(Continued on page 35)

NEWS OF THE FIELD

Allan W. Cuddeback, one of the distinguished water works men of the country and a loyal member of this Association, died on December 4 at his home in New York. He was one of the real leaders among water works executives, only recently having retired as President of the Federal Water Service Company. He was for many years a member of the Association's Board of Directors and was President of the A. W. W. A. in 1927. He contributed much to the preparation of the *Manual of Water Works Practice* and was active in the reorganization of the Association's activities in the mid-twenties that brought it to its present status as a technical organization. He was a fine gentleman, a leader whose passing on creates a real void in the field.

William P. Molis of Muscatine, Iowa, died on November 27 after a lifetime of service to his city's water works plant and its people. He was 83 years old.

He had regularly attended to his duties in the department, but a heart attack caused him to put aside his work and brought about his death after four weeks illness. He had been attached to the water department of Muscatine since 1876. He became a member of the A. W. W. A. in 1882 and was made an honorary member in 1936. He had been a faithful member of the Iowa water works group and was greatly respected by his associates.

Attention, Affiliates! This issue of the Journal is one of the four each year designed to be of particular interest to you. The various papers have been assembled with the idea of giving a bird's-eye view of water works operations.

Harding tells how to buy deep well pumps. Herberg and Tatnall speak from the fire underwriter's standpoint and furnish a fine lot of information not alone concerning how to provide mains and hydrants for fire protection but how to keep things in good order.

McQueen and Lundberg set fine examples of description of plant development by the man in charge. Every water works superintendent

(*Continued on page 2*)

(*Continued from page 1*)

in a medium sized community should assign himself the task of preparing just this type of statement—not alone for his own files, but in order that he may be prepared adequately to tell the facts about his department to any citizen who wants the facts.

Niles and Wolbert picture public relations activities, one from the viewpoint of the private utility, the other as a municipal operator. Plank of Appleton, Wisconsin, an active business man who has been a member of the water commission for many years, briefly records the fine public management of that department—management that every water works man should strive to provide.

No water department can get along without accounting, so every reader should be interested in Adam's discussion of the standard classification of accounts. The distribution maintenance man will find ideas in Jensen's story of the mobile repair shop and in Cranch's paper on water main cleaning. Bliven's story of the big wind that demolished the standpipe will not help the sleep of any superintendent.

It was assumed that a little home study would be useful, so Lendall's first steps in hydraulics and Hulbert's mathematics for the purification plant operator furnish material for self improvement.

Wallace, former executive of the American Engineering Council, outlines the value of research to industry and the consumer. Strickland's review of Canadian treatment practice, Hudson's study of filter sands, and Goudey's well documented criticism of current laboratory methods give the purification plant man ample food for thought.

Seriously, an effort has been made to bring together in this issue a group of papers which would interest the Affiliate as well as the members who receive the Journal every month.

E. S. Tisdale, who for many years has been State Sanitary Engineer of West Virginia, has associated himself with the U. S. Public Health Service at Cincinnati to participate in the stream pollution and control studies.

J. B. Harrington, former assistant to Mr. Tisdale (and Secretary of the new West Virginia Section of the A. W. W. A.), is now State Sanitary Engineer.

Kaarlo W. Nasi has just notified the Association of his transfer to the Territorial Department of Health in Juneau, Alaska. He is the first member that the Association has had in Alaska in a number of years. Mr. Nasi was formerly associated with the Whitman County Health Department in the state of Washington.

(*Continued on page 4*)

Nothing takes the place of
LIGHT
Nothing takes the place of
CAST IRON PIPE

IN the olden days, when the first cast iron underground main was installed, men read by the light from a candle or from oil burning in a shallow vessel. A century later came the lamp chimney, followed by other improvements in artificial lighting, most of which are now obsolete. Yet that first cast iron main is still in service and cast iron pipe, essentially the same material as in 1664, is today the recognized standard for underground mains. Nothing has taken its place. A pipe material must meet 10 requirements for long life and economical service. Some materials meet some of these requirements but only cast iron pipe meets them all.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

Look for the "Q-Check" registered trade mark.
Cast iron pipe is made in diameters from 1¼ to 84 inches.

CAST IRON PIPE
The Standard Material Q *for Underground Mains*

(*Continued from Page 2*)

Improvements in the format of the Journal will be effective with the January, 1939 issue. For some time it has been evident that the thin paper used for the text was not a satisfactory background for illustrations. So a heavier stock of the machine finished type, such as the paper in "Life," will be used. The cover will be a shade heavier. The pages will be stitched instead of stapled as at present. All is being done to make a more attractive and readable periodical. We hope you like it.

The lowest incidence of typhoid recorded in recent years was that for the period of four weeks ending October 8, 1938, according to U. S. Public Health Reports (53:1909 (Oct. 28, 1938)). The number of cases was less than 80 per cent of the number reported for the corresponding period in 1937, and only about 65 per cent of the 1933–37 average. In each region except the Pacific the number of cases was definitely below the seasonal expectancy.

Extra meters are planned for consumers at Martin's Ferry, Ohio, who complain that sewer rentals based on total water consumption are too

(*Continued on page 6*)

BAD WEATHER WON'T BOTHER THIS JOINTING COMPOUND EITHER!

You can store Tegul-MINERALEAD in the open. Rain, snow, hail or flood will make no impression on those 10 lb. ingots • Some time ago a stock of forty thousand lbs. was submerged for days in a Southern flood. When the water receded Tegul-MINERALEAD was already to go to work • QUICK SEALING—Initial leakage in joints made with this sulfur base compound heal quickly. Streets can be cleared up without delay • PERMANENTLY TIGHT JOINTS stand any vibration and are more resistant to mechanical and thermal shock • Use Tegul-MINERALEAD for Jointing your Bell and Spigot Main • For information write The ATLAS MINERAL Products Company of Penna. Mertztown, Pennsylvania

A Tegul PRODUCT

Tegul MINERALEAD

IMPORTANT

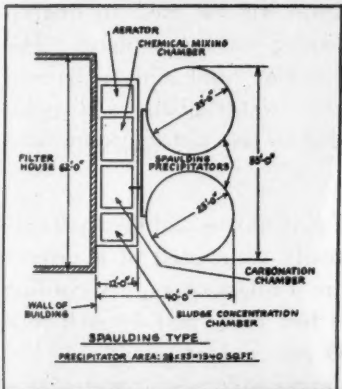
The Association has run short of certain numbers of the Journal. Any member possessing a copy of any of the following issues which he does not wish to keep should advise this office. We will pay 50¢ each for copies to meet the demands of new members.

April.....1936
January.....1937
February.....1937
March.....1937

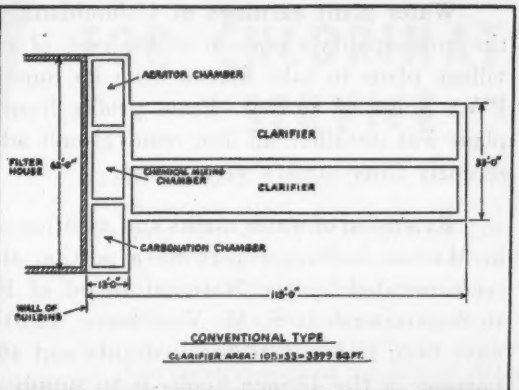
IF YOU HAVE A COPY AVAILABLE, JUST DROP US A POST CARD.

American Water Works Association
22 East 40th St., New York

Permutit's Spaulding Precipitator *Takes the Blue Ribbon* for Cold Lime Treatment



TYPICAL SPAULDING PRECIPITATOR LAYOUT



CONVENTIONAL COLD LIME LAYOUT NEEDS OVER TWICE THE SPACE!

Takes Less Space

Permutit's revolutionary new Spaulding Precipitator takes less than half the space required by conventional type settling basins. It consists of two compartments (see diagram below)—(a) Mixing Zone, and (b) Conical Upflow Sludge Contact Filter. Chemical and raw water enter mixing zone, where agitators mix newly forming precipitates with retained older sludge of controlled density. *No settling takes place* . . . an exclusive feature!

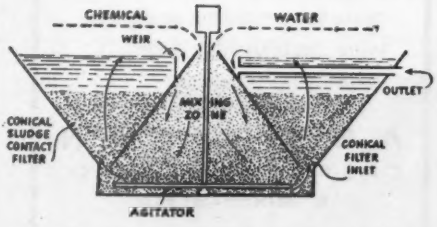
Takes Less Time

In ordinary settling basins, sludge settles from water before full reaction occurs. To correct this, practice has been to return deposited sludge. But this may give treated water bad taste or odor. In the Spaulding Precipitator, however, *sludge is kept suspended*, as explained at left. This exclusive feature speeds up precipitation, keeps sludge fresh. Softening is accomplished without putrefaction—so completely that recarbonation is often unnecessary.

Takes Less Chemicals

Continuous recirculation of preformed sludge cuts down the amount of chemicals necessary. Other features of Permutit's new Spaulding Precipitator: Conical shape of filter compartment makes sludge-filter uniformly dense throughout. Thus the efficiency of the filter is maintained, and effluent is remarkably clear. Correct density of sludge assured by an automatic blow-off arrangement. Other exclusive advantages described in booklet.

These results are obtained every day—in practical operation, in both large and small plants. Complete description of Permutit's new Spaulding Precipitator and how it may also be used for coagulation of turbid or colored waters is contained in a free, authoritative booklet. Write today to The Permutit Company, Dept. G2, 330 West 42nd Street, New York.



Typical cross-section of Spaulding Precipitator

PERMUTIT THE WATER CONDITIONING HEADQUARTERS **OVER 25 YEARS**

(*Continued from page 4*)

high. If requested, a separate meter is to be installed to measure water used for sprinkling and other purposes. The charge by the city division of water for a separate meter is $8.

Water plant earnings at Columbiana, Ohio will be used to finance the municipality's portion of the cost of a water softening plant. The village plans to take $7,000 from its improvement fund and to have a PWA grant of $6,266. From profits from the water plant, a disposal plant was installed, an iron removal unit added to the water system, and recently three streets were paved.

Extension of water mains and addition of gate valves and fire hydrants in Marion, Indiana constitute a portion already completed of a project recommended by the National Board of Fire Underwriters. According to Superintendent S. M. VanCleave, 12,314 feet of 6- and 12-inch pipe have been laid and 16 fire hydrants and 460 gate valves installed. The purpose of the 12-inch mains is to supply larger volumes of water at a higher pressure to suburban districts. Smaller lines were laid to eliminate dead ends.

(*Continued on page 8*)

Cut Pumping Costs

with

MONO-CAST

ENAMELINE

PIPE

Address nearest Acipco office for details on this modern pipe lining which positively prevents tuberculation and maintains permanently high "C" values.

AMERICAN
CAST IRON PIPE CO.
BIRMINGHAM, ALA.

New York City Chicago Kansas City Minneapolis Dallas
Los Angeles San Francisco Pittsburgh Cleveland

RUSTA-RESTOR TRADE MARK REGISTERED
PATS. PEND.

An electrical appliance which eliminates Rusting, Corrosion, Pitting and Painting below the water line in Steel Water Tanks.

Costs about as much as a coat of paint to own, and less than 50¢ a month to operate.

Send for Bulletin 55,
A fine explanation of Rusting

RUSTA RESTOR CORPORATION
FREMONT, OHIO

CRANE PLUG DISC VALVES

FOR CHLORINATION SERVICE

There can be no compromise with the quality of equipment upon which the nation's health depends. That is why Crane designed the Special No. 254P Plug Disc Valve for the handling of chlorine gas for water sterilization.

Here's a valve that is built to do a specific job—with its ability to give better performance in that service backed by Crane design and Crane metallurgy—and a manufacturing experience of more than 80 years.

It's the Crane monel trim in the disc, seat and stem that gives greatest resistance to the corrosive action of chlorine gas. It's the long-tapered disc and the wide seat that permit more positive flow control. But it's Crane engineering all the way through—careful design and perfect balance in every part of the Special 254P, that is the greatest assurance of a longer life of valve efficiency on the chlorine gas lines in your plant.

CRANE

VALVES · FITTINGS · PIPE · PLUMBING · HEATING · PUMPS

CRANE CO., GENERAL OFFICES:
836 S. MICHIGAN AVE., CHICAGO

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

The Crane Special No. 254P Malleable Iron Valve for Chlorine Service. W. P. 400 pounds.

IT'S WHAT'S INSIDE THAT COUNTS!

(*Continued from page 6*)

A water witch has walked over the terrain about College Corners, Ohio, and the town now has great praise for him and its new water supply. College Corners has long sought an adequate water supply, and finally resort was had to a self-styled "water witch" whom the Anderson, Indiana *Herald* reports as Sam Paxton, a retiring young farmer who refused to be photographed or to say much about his work. Paxton, accompanied by engineers and village officials, strolled over proposed sites for a water supply. Officials insisted that the forked twig of a peach tree, held in Paxton's hand, dipped perceptibly at one spot where drillers later reached water at a depth of 30 feet. Village Clerk Frank Snyder, confirming Paxton's employment by the community, said the young farmer "did a good job for us even if the witching business is the bunk."

Water rates have been raised in Jerseyville, Illinois, by an order of the United States district court. Action was taken at the request of a committee of the bondholders of the water works which has been in receivership since 1928 and which is said to have an indebtedness of $283,000. The court order raises the minimum rate from $1.00 to $1.50

(*Continued on page 11*)

EDSON
DIAPHRAGM PUMPS

Hand Operated—size 2", 2½", 3", 4"
Power Operated—size 3" and 4"
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

WHITE
FILTER SAND
98% Pure Silica

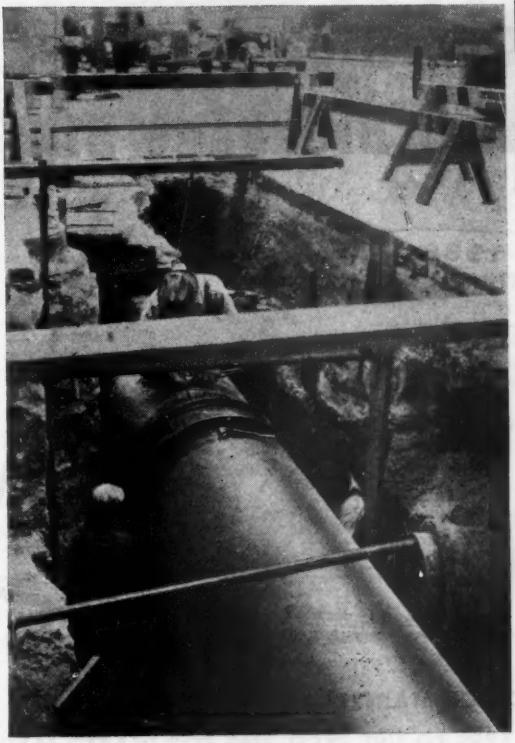
●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

THE ANSWER TO A PROBLEM

ALCO PIPE FOR CHICAGO



Cities using ALCO STEEL PIPE include the following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W Va
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y
New Brunswick, N.J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

The Water Department of Chicago and the Chicago Union Station were jointly and seriously concerned about the material to use in the 36" line to replace pipe running under the tracks of the station. The answer, illustrated above, is Alco Electric Welded Steel Pipe. No further need to worry about disastrous breaks.

ALCO FEATURES

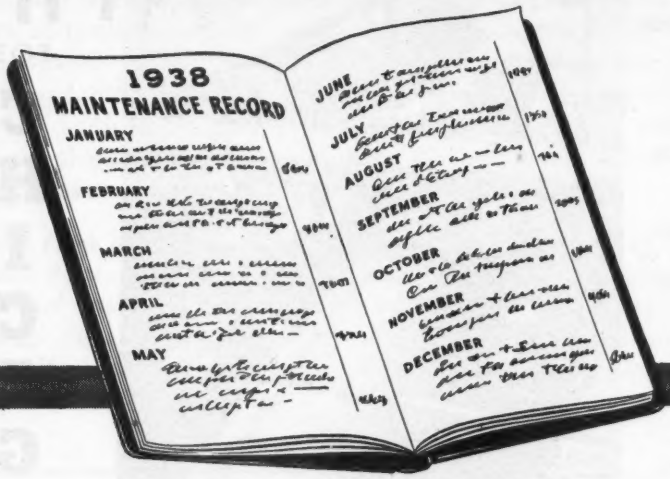
Greater Strength
Longer Life
Smoother Waterway
Longer Lengths
Fewer Field Joints
Low Initial Cost
Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS DIVISION
30 Church Street New York, N. Y.
CHICAGO WASHINGTON PITTSBURGH HOUSTON TULSA
Plants at Dunkirk, N. Y., and Montreal, Canada Cable Address: Alproducts.

AMERICAN LOCOMOTIVE COMPANY

How High Is Your "Annual Breakage Bill"?



CITIES THAT CHECK MAINTENANCE RECORDS CLOSELY KNOW IT COSTS LESS TO USE STEEL PIPE FOR WATER MAINS

Just for comparison, collect all your 1938 bills for repairing "breaks" and leaky joints in water mains. Then add all these costs together. Chances are, the total will be higher than you realized because in many cities the annual cost of maintaining water lines has jumped to more than *$100 per mile of main.* And that doesn't include water losses or service interruptions.

Fortunately you can eliminate most of this trouble and expense on new water supply lines and force mains. Specify Armco Spiral Welded Steel Pipe and you won't need to worry about "sudden breaks" or wasteful joint leakage. Write for the facts. The American Rolling Mill Co., Pipe Sales Division, 3551 Curtis Street, Middletown, Ohio.

ARMCO

ARMCO SPIRAL WELDED STEEL PIPE

APPROVED BY UNDERWRITERS LABORATORIES INC.

But Valueless for Water Purification

Although the diamond is carbon in its most valuable form, it is worthless compared to CLIFFCHAR ACTIVATED CARBON for water purification.

Leading municipalities place high value on CLIFFCHAR to remove objectionable taste and odors from water supply.

CLIFFCHAR "R"

Special Grade for Water Purification

Low phenol value, shown by standard phenol tests, gives high ability to remove phenolic and similar compounds.

Extreme fineness (99% passing a 325 mesh screen) gives maximum surface exposure and adsorptive capacity.

Controlled, uniform density assures sufficient suspension period to take full advantage of its high adsorptive ability, yet settle out in ordinary settling basins.

The technical and laboratory facilities of this company are available without obligation to those concerned with taste and odor problems in water purification. Your inquiry is invited.

Cliffs Dow

REG. U. S. PAT. OFF.

CLIFFS DOW CHEMICAL COMPANY, Marquette, Michigan

Branch Sales Offices: **30 Rockefeller Plaza, New York City; Second and Madison Sts., St. Louis; Field Bldg., Chicago**

(*Continued from page 8*)

a month and raises the hydrant rental charge from approximately $41 to $55 per year. An increase of $8,500 a year in the income of the plant is expected from the raise.

Reduced water rates to charitable and semi-charitable institutions are being considered in Cincinnati. A proposed ordinance would grant free water to institutions obtaining 10 per cent or less of their income from charges and would give a rate of 6 cents a hundred cubic feet to others in the city procuring no more than 50 per cent of the irincome from charges. Comparable institutions outside the city would be charged a 9-cent rate. Another proposition would give free water to institutions receiving no more than 25 per cent of their income from charges and would grant a special rate to those receiving up to 75 per cent other than by charges. A third proposition would give free water to charitable institutions which receive less than 50 per cent of their income from charges and would charge other charitable institutions at a 3-cent rate. Assistant Water Works Superintendent M. F. Hoffman has been requested to prepare a comparison of the change in income effected by the proposed rates.

(*Continued on page 12*)

A. W. W. A. Membership Certificate

Give us your name—exactly as you wish it to appear. Send 40c in coins or postage to cover cost of lettering and mailing, and you will receive a fine newly designed parchment paper membership certificate, 9 x 12 inches in size, ready for framing.

The certificate will reach you within ten days of receipt of order—ready for you to frame and hang in your office.

(*Continued from page 11*)

Mary Mallon, who innocently and erroneously caused many a water department grave concern, is dead. She was "Typhoid Mary" who acquired her pseudonym after becoming the first carrier of typhoid identified in this country. Typhoid Mary was a cook who loved to cook, and even after health authorities had given her parole upon the promise that she would not handle food, she persisted. So in 1915 she began a life term of involuntary isolation, most of which was spent on antiseptic North Brother Island in the East River, New York City.

Typhoid Mary was accused of at least seven deaths, and fifty-seven known cases were attributed to her. Mary was considered a treasure as a cook among the fashionable families of thirty or forty years ago. Mary worked from Maine resorts to Tuxedo and Long Island homes. Finally in the Oyster Bay house of George Thompson, six of a household of eleven were stricken with typhoid. Some attributed the disease to water from a tank on the roof; others said the cause was milk; still others blamed shellfish. Mr. Thompson was not satisfied so he asked Washington authorities to recommend the best man in the typhoid fever field.

George A. Soper, Ph.D., not a physician, but a sanitary engineer, was

((*Continued on page 15*))

FIRST QUALITY METERS EXCLUSIVELY

SPECIFY *American* (BRONZE CASE) or *Niagara* (IRON CASE)

Water Meters

WRITE FOR CATALOG

BUFFALO METER COMPANY

Established 1892 2914 Main St., Buffalo, N. Y.

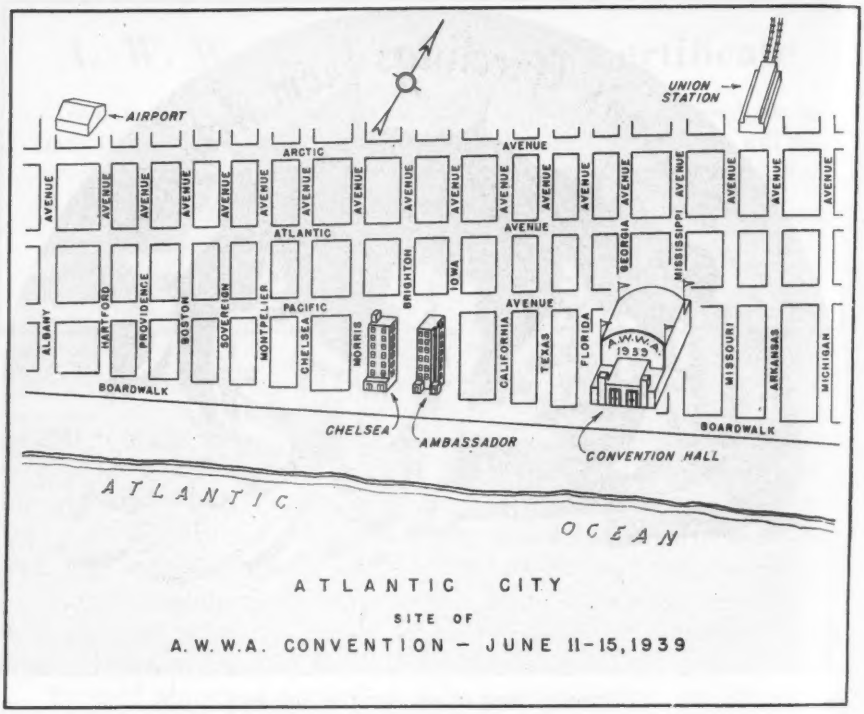
A TYPICAL SCENE IN THE SOUTH AT THIS TIME.

With the holiday season and the new year, we would like to lay aside the every-day routine of business and bring to you compliments of the season.

Developers of the new "High Alumina" Activated Alum

Activated Alum Corp.

New York Office—80 Broad Street, New York City, N. Y. *General Office and Works*—Curtis Bay, Baltimore, Maryland



ATLANTIC CITY

SITE OF

A. W. W. A. CONVENTION — JUNE 11-15, 1939

THE STANDARD

for more than

50 YEARS

WATER WORKS SPECIALTIES

•

Automatic Pressure Control Valves

Pressure Reducing-Altitude

Surge-Relief and Combination Valves

Portable Fire Hydrants

Hydraulic Booster Pumps

ROSS VALVE MFG. CO., INC. TROY, N. Y.

(Continued from page 12)

recommended. Dr. Soper was one of the most distinguished epidemiologists of the time, a colleague of Koch in Germany. Dr. Soper ruled out one by one all the usual causes of typhoid and set to work to get the health records of all the inhabitants of the house. He obtained all the records but that of the cook, Mary Mallon. She had gone on to cook elsewhere, and it took four months to locate her. Bit by bit her record was pieced together in spite of the fact that she had frequently changed her name and moved often. It was soon found that typhoid had not preceded Mary's appearance as cook but that the disease appeared numerous times after she was cooking. Typhoid was attributed to her in Mamaroneck in 1900, in Dark Harbor, Maine in 1902, then in Sands Point, Long Island, and in Glen Cove and Tuxedo Dr. Soper found Mary cooking for a Park Avenue family with two persons ill with typhoid. It required the efforts of five policemen to take Mary to a hospital for examination and later to exile on North Brother Island.

Paroled in 1910 on her promise to keep out of kitchens, Typhoid Mary dropped from sight as was her inclination. An epidemic of typhoid in three homes in Newfoundland, N. J. set the authorities searching for

(Continued on page 18)

SterElators by Everson

Safe, accurate, efficient, easy to operate —and above all dependable.

- Automatic Water Shut Off
- Automatic Gas Shut Off
- Automatic Synchronization with pump
- Accurate Rota Meter (plus or minus 1%)
- Single Valve Regulates Gas Flow
- Full Vacuum Operation
- Tremendous Capacity Ratios (1 to 10, even 1 to 40)

The very last word in waterworks, sewage, and swimming pool sterilizing equipment.

Write for Bulletin No. 1004

EVERSON MANUFACTURING COMPANY
221 W. Huron St., Chicago, U. S. A.

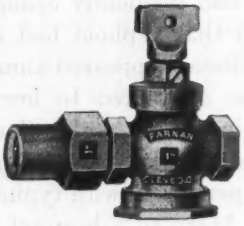
The same basic EVERSON SterElator that is giving complete satisfaction in hundreds of swimming pools.

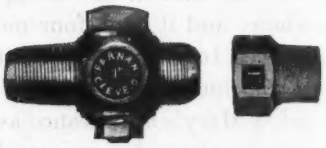
MEASURE, MIX and FEED CHLORINE GAS

FOR 86 YEARS

the best service

quality workmanship





Our complete line consists of corporation and curb stops, couplings and fittings for copper, lead or IRON SERVICE PIPE.

FARNAN BRASS WORKS CO.

CLEVELAND *ESTABLISHED 1852* **OHIO**

American Water Works Association

59th Annual Convention

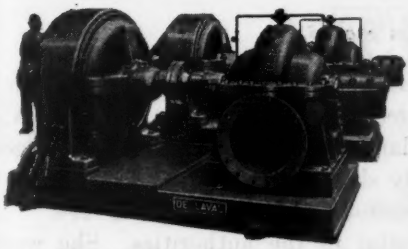
Atlantic City, June 11-15, 1939

Housing Headquarters—Ambassador and Chelsea Hotels

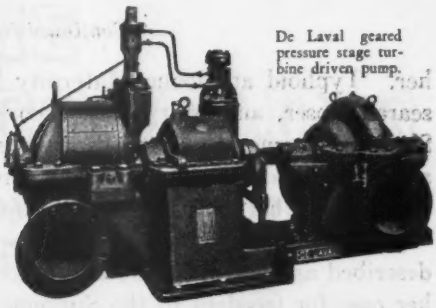
(*see map on page 14*)

Single Rooms	**Ambassador**	**$ 3.00 to $ 6.00**
	Chelsea	**3.00 to 5.00**
Double Rooms	**Ambassador**	**6.00 to 10.00**
	Chelsea	**5.00 to 8.00**
Suites (2 rooms)	**Ambassador**	**12.00 to 20.00**
	Chelsea	**8.00 to 10.00**
Rooms without bath	**Chelsea**	**2.50 to 4.00**

Make Your Reservations Now



De Laval motor driven pumps, 12,500 g.p.m., each against 55 ft. at 875 r.p.m.



De Laval geared pressure stage turbine driven pump.

4 GOOD REASONS *for using* DE LAVAL PUMPS

1. DE LAVAL PUMPS ARE INITIALLY EFFICIENT

Because of the use of labyrinth wearing rings, high efficiency is obtained without resorting to undesirably close running clearances. Correct hydraulic design saves power.

2. DE LAVAL PUMPS RETAIN THEIR EFFICIENCY

The labyrinth wearing rings sustain the efficiency much longer than do flat wearing surfaces.

3. DE LAVAL PUMPS HAVE LOW MAINTENANCE EXPENSE

Only materials that are most suitable and of the best quality are used in their construction. The horizontally split casings make all parts easily accessible without disturbing piping connections. All parts are interchangeable, being made to limit gages, and parts subject to wear, such as wearing rings, shaft sleeves, casing protecting bushings and bearings are readily replaced by new parts, without fitting.

4. DE LAVAL PUMPS PERFORM AS REPRESENTED

They are fully guaranteed and thoroughly tested for efficiency and head-delivery characteristics and for perfect mechanical operation.

●

DE LAVAL STEAM TURBINE CO.

TRENTON, N. J.

(*Continued from page 15*)

her. Typhoid at Sloane Maternity Hospital in New York brought the search closer, and Mary was discovered hiding in Corona, New York. She was returned to North Brother Island where she was given a cottage and work to do in a laboratory. Only short visits to the city from the island broke her exile there for the remainder of her life.

Typhoid Mary was always resentful of the authorities. She was described as unco-operative and lacking in understanding and she carried her case for freedom to the Supreme Court of New York State with no avail. Thus ended the case of the first known typhoid carrier in this country, whose discovery was a great advance in typhoid epidemiology.

A 40,000,000 gallon daily water supply is the object of a special water commission in Westchester County, New York. Most of the fifty water companies and departments in the county now receive their water from the Catskill division of the New York City supply. It is said that signification by New York City that it desired to raise the rate from $100 a million gallons to $105 has spurred the survey by the commission and its three engineers. This survey has reached as far as the Housatonic

(*Continued on page 20*)

The fire hydrant for maximum economy-safety-dependability

IF A Kennedy SAFETOP hydrant is struck by a smashing impact, there is no flooding, the water supply need not be shut off while awaiting or making repairs, and the hydrant can be returned to service by one man, within half an hour, without excavating, and at a total cost of less than $10.00 for new parts and labor.

In addition to these important benefits, the Kennedy SAFETOP Fire Hydrant responds promptly and effectively to service demands. Its large-diameter standpipe and smooth water passages keep pressure loss to a minimum, and its simple, sturdy, straight-line mechanism functions easily and positively.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY
SAFETOP
REG. U.S. PAT. OFF.
FIRE HYDRANT

THE SIMPLEX COUPLING

Another reason why Transite Pipe is the Economical Water Carrier

Easily assembled, flexible, bottle-tight, SIMPLEX COUPLINGS lower installation and maintenance expense, help keep pressure high and pumping costs permanently low . . .

THE Simplex Coupling used on Transite Pipe saves money during installation and helps greatly to keep maintenance and pumping expense permanently low.

No caulking with Simplex Couplings. Hence rapid assembly by unskilled labor. No large bell holes either; trenching costs are less.

Furthermore, Transite's flexible Simplex joints are permanently bottle-tight. They prevent the breaks in mains, the heavy maintenance expense, so often caused by leaks washing away supporting soil.

And by also preventing a multitude of lesser leaks, Simplex joints help maintain constant pressure and eliminate the costly pumping of water that, through leakage, never reaches the consumer.

And as for Transite, the pipe . . . It is built for permanence. It is designed to end corrosion troubles, inside, outside, clear through. Transite means lower installation costs, lower maintenance costs, lower pumping costs. In every respect, Transite Pipe is the economical water carrier.

For full details, address Johns-Manville, 22 E. 40th St., New York, N. Y.

UNSKILLED LABOR equipped with a special jack-type puller assembles Simplex Couplings with notable speed and economy. Note the narrow trench; the absence of the customary large bell holes.

Johns-Manville
TRANSITE PRESSURE PIPE
An Asbestos Product

(*Continued from page 18*)

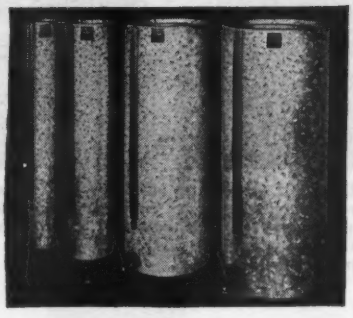
Valley in Connecticut and Massachusetts. Due to New York City's control of most of the drainage areas in Westchester County, that county must seek a water supply outside its limits. The commission reports that seeking water in Putnam and Duchess Counties seems most feasible.

Malcolm Pirnie, one of the engineers, explained the proposed system to mayors and other public officials of the area. The commission says that the system would be entirely self-supporting and that the rate to existing distribution systems would be $90 a million gallons for filtered and $78 for unfiltered water. An estimated cost of $19,723,000 was given as the total for the following: a dam on Conopus Creek to develop a thirteen-square-mile drainage area in the vicinity; development of an Oscawana Brook area of six square miles; a twenty-nine-square-mile drainage area on Peekskill Hollow Creek; a purification plant; necessary pumping stations; and an aqueduct across Westchester County.

The above system would supply 38,000,000 gallons daily. To increase the supply, choice of the following supplies was offered: a ten-square-mile area on Clove Creek to be developed at a cost of $2,620,000 and yielding 8,000,000 gallons; an area of six square miles in the Indian

(*Continued on page 22*)

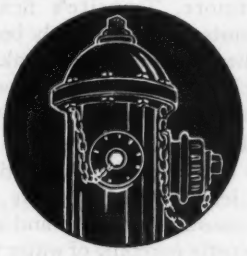
Ford Calibrated
TESTING TANKS



These tanks are made in four sizes. They are heavily galvanized and provided with percentage calibration, gauge glass and quick-opening drain valve. Simple and easy to use. Hundreds in use. Write for information.

The Ford Meter Box Co.
WABASH, INDIANA

Kupferle pioneered in the making of fire hydrants—and has stayed at the head of the procession ever since.



Two distinct styles for public and private installations—six different sizes, complying with the specifications of the American Water Works Association.

Specification sheets sent on request

John C. Kupferle
Foundry Co. St. Louis

KUPFERLE
FIRE HYDRANTS

Experienced Water Works men invariably point to the

HERSEY WATER METER

as the outstanding example of water meter efficiency

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

Branch Offices: New York—Portland, Ore.—Philadelphia—Atlanta—Dallas—Chicago
San Francisco—Los Angeles

(*Continued from page 20*)

and Philipse Brooks to yield 4,700,000 at a cost of $1,360,000. A 50,000,000 gallon supply could be added by development of an area of 156 square miles in the Fishkill Creek at a cost of $10,000,000. A part of this cost would be that of increasing existing plant to handle such a supply.

The commission suggested an alternate plan to all of the above as an expenditure of $9,900,000 to build an aqueduct through the county and to arrange a lease with New York City for the Croton reservoir and watershed. Immediate steps that the special commission recommended were: authorizing test borings at proposed sites of dams and aqueducts; seeking of pledges from county water systems; application to the New York State Water Power and Control Commission for permission to obtain water from other counties; securing an enabling act from the state legislature; negotiation with New York City for a lower rate; and appropriation of $10,000 for further study.

Sewage disposal facilities are being considered for Cincinnati where it is claimed 160,000,000 gallons of sewage are discharged daily above the intake for the city water supply. The Cincinnati *Enquirer* reports, "Last

(*Continued on page 26*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2″ to 84″

Flanged Pipe ***Flexible Joint Pipe***

Bell and Spigot Pipe

Special Castings ***Short Body B. & S. Specials***

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

DEPENDABLE ALWAYS!

IT takes real skill and scientific knowledge to make a compound like Hydro-Tite. A compound that will make 60-inch joints as easily as 6-inch. A compound that takes up quick—that is always strong, flexible and tight. We believe, and our sales prove, that we alone have such skill and knowledge.

Over **24 Years Without a Failure**

HYDRAULIC DEVELOPMENT CORPORATION

Main Sales Office: 50 Church Street, New York, N. Y.
General Offices and Works: West Medford Station, Boston, Mass.

HYDRO-TITE

Reg. U. S. Pat. Off.

A DEPENDABLE SELF-CAULKING JOINT COMPOUND

DIRECTORY OF EXPERTS

JOHN W. ALVORD — LOUIS R. HOWSON
CHARLES B. BURDICK — DONALD H. MAXWELL

ALVORD, BURDICK & HOWSON
Engineers

Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation

Civic Opera Building — Chicago

E. B. BLACK — N. T. VEATCH, JR.
A. P. LEARNED — E. H. DUNMIRE — J. F. BROWN
C. L. DODD — F. M. VEATCH

BLACK & VEATCH
Consulting Engineers

Sewerage, Sewage Disposal, Water Supply, Water Purification, Electric Lighting, Power Plants, Valuations, Special Investigations and Reports.

Kansas City, Mo., 4706 Broadway

BURNS & McDONNELL ENGINEERING CO.

McDONNELL-SMITH-BALDWIN-TIMANUS-McDONNELL

Consulting Engineers since 1897

Waterworks, Light and Power, Sewerage, Reports, Designs, Appraisals, Rate Investigations.

Kansas City, Mo. 107 West Linwood Blvd.
Cincinnati, Ohio 307 East Fourth Street.
Albany, New York 11 No. Pearl Street.

JAMES M. CAIRD

Cannon Bldg., Broadway and Second Street
Troy, N. Y.
Assoc. Am. Soc. C. E.
Chemist and Bacteriologist
Water Analysis

SPECIALTIES—Tests of Filter Plants, Examinations and Reports upon Proposed Sources of Water Supply; the Copper Sulphate Treatment for Algae; Expert Testimony.

Campbell, Davis and Bankson

THE CHESTER ENGINEERS

Water Supply and Purification, Sewerage and Sewage Treatment, Power Development and Applications.

Investigations, Appraisals, Rates, Testimony, Design, Supervision, Operation, Accounting.

130 Seventh Street — PITTSBURGH, PA.

FULLER & EVERETT
(formerly Hazen & Everett)
Civil Engineers

Weston E. Fuller — C. M. Everett

WATER WORKS

Design, Construction, Operation, Valuations, Rates

22 E. 40th Street - New York City

FULLER & McCLINTOCK
Engineers

Sewage Treatment, Sewers, Waterworks, Purification, Drainage, Waste Disposal, Valuations

11 Park Place, New York.

MORTIMER M. GIBBONS
Sanitary Chemist

Chemical and Bacteriological Analyses.
Supervision of Filter Plants and Swimming Pools.
Watershed Control.
Industrial Wastes Treatment

961 Frelinghuysen Avenue
Newark, New Jersey.

GREELEY & HANSEN
Hydraulic and Sanitary Engineers

Water Supply, Water Purification, Sewerage, Sewage Treatment, Refuse Disposal Investigations, Reports, Designs, Construction Supervision, Appraisals and Consultation.

6 North Michigan Ave., Chicago, Illinois

NICHOLAS S. HILL ASSOCIATES
Consulting Engineer

WATER SUPPLY—SEWAGE DISPOSAL—HYDRAULIC DEVELOPMENTS

Reports, Investigations, Valuations, Rates, Design, Construction, Operation, Management
Chemical and Biological Laboratories

112 E. 19th St., New York City

MORRIS KNOWLES, INC.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.
Pittsburgh, Pa.

ALEXANDER POTTER
Consulting Engineer
Specialties: Water Supply and Sewerage
50 Church St. New York City
Telephone 5501 Cortlandt

METCALF & EDDY
Engineers
Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories Valuations
Boston, Mass. **Harrisburg, Pa.**
Statler Building **Telegraph Building**

CLYDE POTTS
M. Am. Soc. C. E.
Consulting Sanitary Engineer
30 Church Street - - New York
Sewerage and Sewage Disposal
Water Works and Water Supply
Reports, Plans and Estimates

REEVES NEWSOM
Engineer - Consultant
Supply, Purification and Distribution of Water
Operation Design Construction
Valuation Rates Negotiations
Investigations Taxes Accounting
500 Fifth Avenue New York City

SCOFIELD ENGINEERING CO.
Consulting Engineers
Water, Gas, Electric Plants and Distribution Systems
Appraisals, Valuations and Reports
Design—Supervision—Operation
Philadelphia, Penna.

PEASE LABORATORIES, INC.
39 West 38th Street, New York
Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swimming pool control.
Chemists Field Sanitary Surveys
Bacteriologists Consultants

WESTON & SAMPSON
Robert Spurr Weston **G. A. Sampson**
Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.
14 Beacon St. Boston, Mass.

MALCOLM PIRNIE
Engineer
Water Supply, Treatment, Sewerage,
Reports, Plans, Estimates,
Supervision and Operation
Valuation and Rates.
25 W. 43rd St., New York, N. Y.

WHITMAN, REQUARDT AND SMITH, *Engineers*
EZRA B. WHITMAN NORMAN D. KENNEY
GUSTAV J. REQUARDT ROBERT T. REGESTER
BENJAMIN L. SMITH THEODORE W. HACKER
WATER WORKS - SEWERAGE - UTILITIES
Baltimore, Md. Albany, N. Y.

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Penstock Gaugings
50 Church St. New York City

Help Build up Your Association by Bringing in a New Member
SEND FOR APPLICATION BLANK
AMERICAN WATER WORKS ASSOCIATION
22 East 40th St. NEW YORK CITY

(*Continued from page 22*)

summer the raw river water tested 28,840 bacillus coli in each 100 cubic centimeters." Cincinnati is now satisfied with the color and palatability of its water but it is beginning to think that its bacteriologists should not have to remove so much pollution from the water in order to deliver a safe and germ-free water to the public.

Toledo, Ohio citizens are water conscious according to the Toledo *Times* which reports the success of Water Commissioner Robert W. Furman's educational campaign. That the educational program has made the consumers conscious of water as the most essential commodity that must be placed in their budgets is said to be a major reason why Toledo came through the depression with a balance in its funds.

Payments on bills are said to have increased with the consciousness that water is a valuable resource and that the water department is operated strictly as a business. A new system of sending statements to delinquent consumers has been put in operation. The first statement shows the amount of delinquency after the regular bill has been ignored. The second statement reminds the consumer that he has received a previous

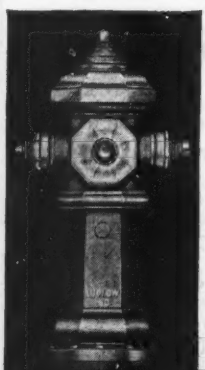
(*Continued on page 28*)

LUDLOW HYDRANTS

always work!

Special design and construction protect Ludlow Hydrants from sub-zero temperatures. Water is drained off from the bottom—cannot freeze in the barrel. This means a big saving in maintenance, eliminating need for digging and replacing. These hydrants always save on water, the valves being perfectly seated to prevent leakage and undue wear.

Send for the complete Ludlow catalog of standard and special purpose hydrants, sluice gates, and valves of all types.



The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

It makes NO difference to

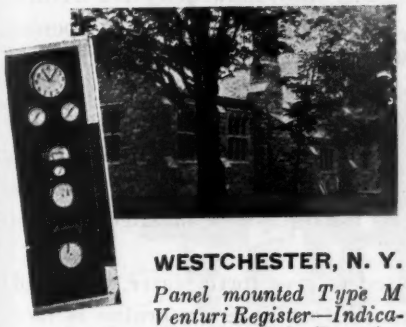
% PROPORTIONEERS %

"Perchloron"
"HTH"
"Columbia"
"Wil-Chlor"
"Maxochlor"
"Purex"
"Chlorofectant"
"Chlorox"
"Isco"
"Kohnstamm"
"Clor-O-Mor"

***Accurately fed by Chlor-O-Feeders,* these chemicals have all been proved practical in chlorinating medium and small water and sewage plants; and even to sterilize big plants in emergencies.**

% PROPORTIONEERS, Inc. %
18 Codding St., Providence, R.I.

FLOW AND LEVEL METERS FOR THE COMMUNITY PLANT



WESTCHESTER, N. Y.

Panel mounted Type M Venturi Register—Indicator—Recorder at Rye Lake Pumping Station.

NEW ROCHELLE, N. Y.

Chronoflo Transmitters in the Metz Reservoir Gate House transmit water level to distant Chronoflo Recorders. Venturi Meter measures flow

Experienced engineers and superintendents of small, large, and medium size plants choose Builders Venturi and Chronoflo Meters and Controllers to aid in maintaining initial efficiency and in keeping down cost of operation.

Bulletin 298 shows many new applications of Chronoflo Meters. Would you like it?

BUILDERS IRON FOUNDRY

"Builders of the Venturi Since 1891"

9 Codding St. Providence, R. I.

STRONG BLACK CIGARS

KEPT THE PLAGUE AWAY

Not so many more than a hundred years ago, men smoked the strongest cigars they could obtain to kill the plague germs that might lodge in their throats.

We know better today. But it was a long time before people of past generations connected their impure water systems with the horrible scourges that periodically wiped out towns and cities.

Liquid Chlorine, "the great purifier," is used almost universally in water systems as the primary means of disease elimination. Water-works officials no longer must be sold on Chlorine's merits.

But state and municipal authorities *must* be assured of quick and adequate supplies of Liquid Chlorine . . . assured of good advice and adequate technical assistance when they need it! The "Big 3" Solvay plant service is a service system upon which water-works men can always depend for supplies and assistance.

Solvay Liquid Chlorine shipments are now routed from Syracuse, New York; Hopewell, Virginia; and Baton Rouge, Louisiana. Your inquiries on Solvay Liquid Chlorine are cordially solicited. Write for complete information in Solvay's "Big 3" service.

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 RECTOR STREET NEW YORK, N. Y.

SOLVAY

LIQUID CHLORINE

(*Continued from page 26*)

one which has received no attention. The third notice says that water will be turned off in five days unless attention is given to it. The third notice usually brings payment or brings the consumer into the office where a force of six employees is available to interview consumers. These interviewers explain that the water department must operate like a business and to those who complain of excessive bills they show defective fixtures and charts of leakages caused by leaks, for instance, that a $\frac{1}{8}$-inch opening will leak 3,806 gallons a day, 114,180 gallons a month and 1,389,190 gallons in a year.

Delinquent consumers and other visitors to the water department are given pamphlets which show the value of water as a natural resource, the operation costs of the department, etc. The pamphlet, prepared under the direction of Mr. Furman and Edward R. Barrett, office manager, says in part:

"If all the faucets at one time ceased to give forth water, the whole structure of civilization would crumble. Within 24 hours armies of men, women and children would abandon all of their possessions, everything—shelter, food, clothing, property, and would go groping through the night, sniffing for, searching for, listening for the sound of water."

(*Continued on page 30*)

CLEAN YOUR WATER MAINS

One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

50 Church St., New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.

THANKS a million . . .

MUSICALLY SPEAKING we may not be much on the "Harmony stuff" but we just can't help raising our voices in sincere appreciation to all our associates for their willing and friendly cooperation.

IN LOOKING BACKWARD we hope that we have contributed in some small measure, something towards making your daily tasks easier and more enjoyable.

ON LOOKING FORWARD we hope that we shall continue to be considered as friends and counselors in our future relationships.

Merry Christmas and a Happy New Year

INDUSTRIAL CHEMICAL SALES
DIVISION OF WEST VIRGINIA PULP & PAPER CO.
230 PARK AVENUE, NEW YORK, N. Y.

1322 Widener Bldg. Philadelphia, Pa.
205 W. Wacker Drive Chicago, Ill.
417 Schofield Bldg. Cleveland, Ohio

(*Continued from page 28*)

The city of Toledo is looking forward to completing its new $9,000,000 lake water project and feels fortunate in having $400,000 left in its water works fund after having paid its share of $3,600,000 toward the project.

Open house held by the Monroeville, Ohio, Board of Public Affairs celebrated the opening of Monroeville's new purification and softening plant. The plant was begun March 12 and was built with government aid. It has a capacity of 250,000 gallons daily and is qualified to treat 50 per cent more by the State Health Department. Water is drawn from the Huron River by two low-pressure pumps. The two filters have a normal capacity of 125,000 gallons daily each, and the clear-water basins have a capacity of 50,000 gallons each.

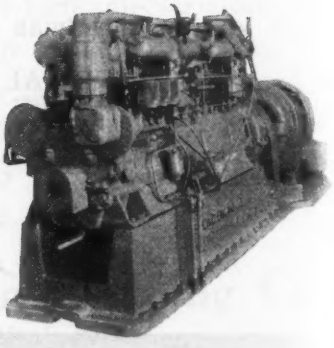
Cost figures for water works improvements have been approved by the City Commission of Sandusky. The $820,000 cost is divided as follows: water pumping and treatment equipment, $315,000; piping and filter equipment, $120,000; pumping equipment, $21,000; electrical work, $34,000; cost of connecting main running from the lake to the plant,

(*Continued on page 33*)

QUICK STARTING ENGINES

Capable of accepting immediate load—Extremely accurate governing—With Underwriters' Laboratory approval—Smooth under load, vibration eliminated—Are essential requirements for—Emergency sets for public building installations:

Sterling



185 K.W. General Electric Generator direct connected to 1200 R.P.M. Sterling Dolphin 8-cylinder 240 H.P. engines, mounted on spring supported bedplate.

STERLING ENGINES QUALIFY FOR THE MOST IMPORTANT EMERGENCY SERVICE.

STERLING ENGINE COMPANY

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

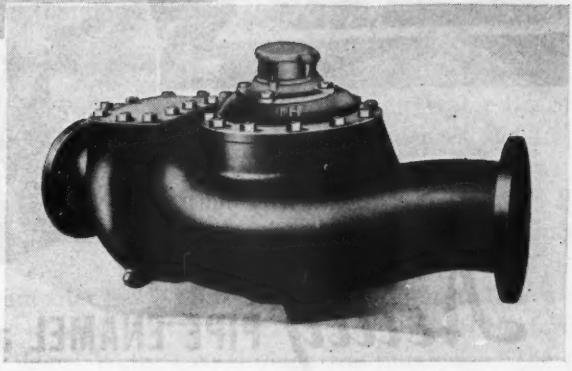
Dept. C-3

Branch Office
900 Chrysler Bldg.
New York, N. Y.

WATCH DOG METERS

Frost-proof meter

Turbine meter



Investigate these meters

. . . more than 3,500,000 now in use

WHEN looking over your requirements, remember that thousands of municipalities are getting satisfactory low-cost service from Worthington-Gamon Meters.

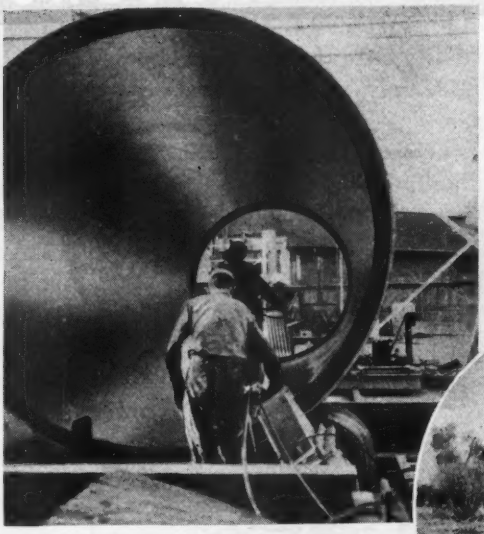
WORTHINGTON-GAMON METER COMPANY

General Offices: HARRISON, NEW JERSEY

Offices and Representatives in Principal Cities

WORTHINGTON-GAMON

WG8-7



DEPENDABLE PROTECTION

Reilly PIPE ENAMEL and PRIMER

SAFEGUARD YOUR INVESTMENT....

DEPENDABLE PROTECTION of water pipe lines and conduits against rust, corrosion, tuberculation and other destructive agents is assured when all metal surfaces, *inside and out*, are coated with REILLY PIPE ENAMEL and PRIMER. These thoroughly tested and proved coatings form a permanent bond to the metal, are abrasion resistant and safely withstand a wide range of temperature changes. Will not crack or peel at temperatures as low as minus 20°—nor flow or sag at temperatures approaching 200° F. Easily applied by centrifugal spinning, rolling rig, or hand daubing.

Reilly COAL TAR PRODUCTS

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN · PLANTS · TO · SERVE · YOU

For maximum water revenue
with the lowest maintenance
for the longest period of time

Investigate **NATIONAL** *Meters*

NATIONAL METER COMPANY, 4207 First Ave., Brooklyn, N. Y.

(*Continued from page 30*)

$3,234; connecting force main on First Street, $9,352; land easement, $4,000; engineering and inspection, $35,500; intake main, $195,190; 24-inch force main, $73,168; miscellaneous printing $1,500; and contingent items, $10,351.

Lower water rates have been refused by the Detroit Water Board to the Young Women's Christian Association for its residences and for its international center branch. It was pointed out that the cafeteria at the Center branch was in direct competition with nearby restaurants. Free water was, however, granted for the gymnasium and baths at the center.

A water works pamphlet has been issued by the Elkhart, Ind. water works, giving a history of public water service from the time of the formation (in 1884) of the Elkhart Water Co., through the purchase of the privately-owned utility, by the city (in 1925) to the present time. The information has been distributed to about 8,500 persons and industrial users of the city water. Improvements and extensions in pumping and distributing facilities are described. Those made by the city water department after the purchase of the utility include: installation of a $1\frac{1}{4}$-million gallon reservoir, erection of a $\frac{1}{2}$-million gallon elevated tank, extension of mains, and addition of wells to a sub-pumping station.

According to the pamphlet, the present water system has $87\frac{1}{2}$ miles of cast-iron mains and 605 fire hydrants. The system serves 8,440 homes, factories and business houses, of which 8,292 are metered. The pamphlet describes the laboratory and the daily tests conducted. Financial matters are dealt with in detail; $90,292.50 was paid out of revenues in 1937 to meet bond interest and bond maturities.

Elkhart's plan to disseminate understandable information about the business and management of its water department is similar in technique and philosophy to the work being done by some of the more progressive corporations in their public relations.

(*Continued on page 38*)

It's there—even tho' you can't see it!

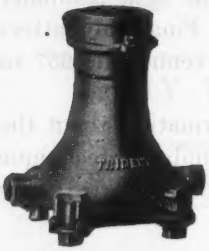
Courtesy "Electronics"

1892 1938

—like Trident Meter Quality . . .

The human eye never sees, and the camera rarely catches multiple flashes of lightning actually blown together in a high wind. Neither may you be able to perceive unaided the multiplicity of fine points about today's Trident Water Meters, built by modern precision shop equipment to standards of precision, closer tolerances and finer finish that only our super-gauges reveal! Gone with the wind are yesterday's standards of precision in Trident Meter production . . . today these meters make possible higher percentages and closer range of ACCURACY, perfect interchangeability, longer life, lower maintenance costs . . . striking proof of the value of Neptune pioneering in precision methods of water meter manufacture.

Neptune Meter Company, 50 West 50th St. (Rockefeller Center), New York City; Neptune Meters, Ltd., 345 Sorauren Ave., Toronto, Canada. Branch Offices in Principal Cities of the United States.



FROST PROOF

TRIDENT

PRECISION-BUILT WATER METERS

CHANGES IN MEMBERSHIP

(*Continued from page vi*)

SIMMONS, PAUL D. Chemist, Weirton Improvement Co., Weirton, W. Va.
SPAFFORD, H. A. Asst. San. Engr., Dept. of Public Health, Capitol Bldg., Springfield, Ill.
TASSIE, GILBERT C. Gen. Mgr., Vernon Irrigation Dist., Vernon, B.C., Canada.
TRAVIS, A. RAYMOND, JR. Salesman, Turbine Equipment Co., Midland Park, N. J.
UNDERWOOD, GOLDEN. Supt., Parkersburg Water Dept., City Bldg., Parkersburg, W. Va.
VINCENZ, J. L. Comnr. of Public Works, City Hall, Fresno, Calif.
WATSON, H. G. City Engr., 801 E. 17th St., Cheyenne, Wyo.
WENRICH, H. P. Engr., California Water Service Co., San Mateo, Calif.
WENTWORTH, WILLIAM EDGAR. San. Engr., P. O. Box 775, Vallejo, Calif.
WEISSE, F. W. E. Supt. Meter Dept., Central Power & Light Co., Corpus Christi, Texas.
WINSTON, HERBERT OWEN. Sales Engr., Layne-New York Co., Inc., 1200 West Elizabeth Ave., Linden, N. J.
WIRTZ, GEORGE L. Secretary, Atlas Mineral Prod. Co. of Pa., Mertztown, Pa.

Corporate

Dept. of Public Works, Mr. J. McClure Wardell, Supt. of Public Works, City Hall, Hudson, N. Y.
Water Dept., City Hall, Inglewood, Calif.

Associate

American Pipe & Steel Corp. Mr. Jack Lane, 230 Date Ave., Alhambra, Calif.
Fraser Cement Products Co. 3115 San Fernando Road, Los Angeles, Calif.
Griffin Chemical Co. Mr. Richard G. Shaler, 1000–16th St., San Francisco, Calif.

Affiliates

BOYD, H. W. Supt. Water Dept., Box 323, Williamstown, W. Va.
CULLEN, PAUL S. Owner, New Cumberland Water Works, New Cumberland, W. Va.
ELLIS, CALVIN F. Maintenance Dept., Water Dept., Moorestown, N. J.
FLORENCE, HAROLD V. Genl. Foreman, Water Dept., Ridgewood, N. J.
FLUHARTY, J. R. Operator, Pine Grove, W. Va.
GRAY, H. M. Technical Director, Cherry River Paper Co., 187 Riverside Drive, Richwood, W. Va.
GRIFFIN, WALTER C. Asst. Engr., Washington Suburban San. Dist., 34 Lincoln Ave., Takoma Park, Md.
HALL, RICHARD F. Supt., West Va. Water Service Co., East Rainelle, Va.
JOHNSON, MEREDITH E. State Geologist, State of N. J., State House Annex, Trenton, N. J.
KRANASKAS, A. J. Asst. Engr., Div. of San. Engineering, State Health Dept., Capitol Bldg., Charleston, W. Va.
LEWIS, FRED E. Filter Plant Operator, 707 Washington St., Huntingburg, Ind.
MCCALL, R. G. Asst. San. Engr., W. Va. Health Dept., 1541 Lee Street, Charleston, W. Va.
MILLAR, JOHN H. San. Engr., Boone County Health Dept., Madison, W. Va.
MORGAN, E. A. Wellsburg, W. Va.
PERKINS, PERCY M. Asst. Mech. Engr., Dept. of Public Works, 601 Water Board Bldg., Detroit, Mich.
RIKER, RUSSELL I. Engineer, Boro of Princeton, N. J., Boro Hall, Princeton, N. J.
SANDY, C. R. Supt. Mun. Water Works, Sistersville, W. Va.
STEPP, W. H. Filter Operator, Kermit, W. Va.
TOPHAM, W. R. Asst. Chief Chemist, Electro Metallurgical Co., Alloy, W. Va.

(*Continued on page 36*)

Trade Mark MABB'S Reg. U. S. Pat. Off.

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

(Continued from page 35)

WATSON, KENNETH S. Chemical Engr., Div. of San Eng., W. Va. State Water Comm., Charleston, W. Va.

Reinstatements (Active)

ADAMS, JOHN M. Town Engr., Hammerton, N. J.
BOYNTON, PERKINS. Chemist-in-Charge, Clarksburg Water Board, 624 Locust Ave., Clarksburg, W. Va.
COLLINS, THOMAS E. Chief Engr., Water Dept. City Hall, Elizabeth, N. J.
EBERLING, CARL A. Supt., Water Works Dept., Room 138, City Hall, Cincinnati, Ohio.
GREENLEE, J. L. Asst. Supt., Municipal Water Dept., Charlotte, N. C.
JACOBS, L. L. Asst. Supt., Newnan Water & Light Comm., Newnan, Ga.
KIRCHMAN, WILLIAM. Chemist, Filter Plant, Fairmont, W. Va.
KUPPER, C. J. Cons. Engr., 409 East Main St., Bound Brook, N. J.
MCCARTHY, CAL. Asst. Supt., No. Jersey District Water Supply Comm., Wanaque, N. J.
SINCLAIR, HAROLD. Turbine Equipment Co., 75 West Street, New York, N. Y.
STEAD, FRANK M. San. Engr., Los Angeles County Health Dept., 431 Grand Ave., South Pasadena, Calif.

Transfers between Sections

LEON G. WILLIAMS from New York to Ohio.
SIDNEY W. WELLS from Indiana to Florida.
EMANUAL H. PEARL from Southwest to New England.
H. A. MOFFAT from Illinois to Michigan.
E. A. MUNYAN from Ohio to West Virginia.
KAARLO WILLIAM NASI from Pacific Northwest to Alaska.
ARTHUR B. CRONKRIGHT from New Jersey to New England.

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.
Lawrenceburg – Indiana

WELL SCREENS

To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.

2304 Long Avenue, St. Paul, Minn.

SAVE 80% ON YOUR TRENCHING COSTS WITH A
GIANT PIPE PUSHER

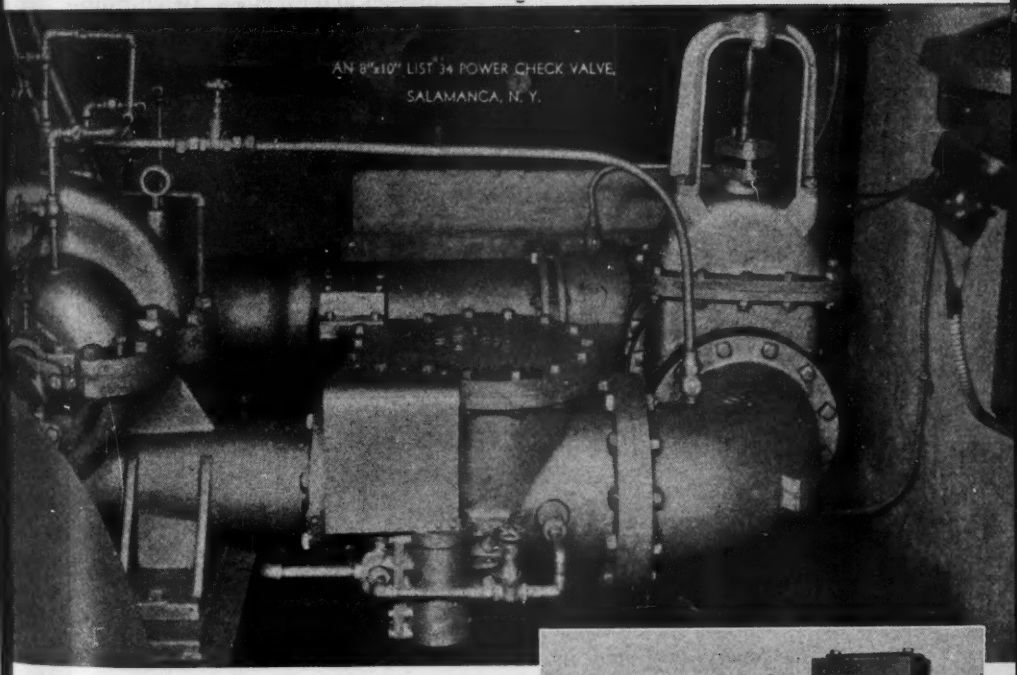
10 DIFFERENT SIZES TO FILL EVERY NEED
WRITE FOR CATALOG
Dept. P-3
GIANT MFG. CO.
Council Bluffs, Iowa

POMONA PUMPS
WATER LUBRICATED TURBINE
Oceans of Water
POMONA PUMP CO.
POMONA, CALIFORNIA
LOS ANGELES 406 S. MAIN ST. CHICAGO 53 W. JACKSON BLVD.

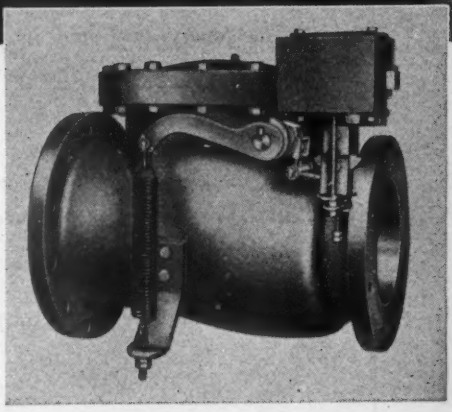
FOR QUIET CLOSURE & MAXIMUM EFFICIENCY—INSTALL

RENSSELAER

LIST 34 POWER CHECK VALVES



AN 8"x10" LIST 34 POWER CHECK VALVE,
SALAMANCA, N. Y.



- **Positively eliminates slam on pump shut-down.**
- **Full clearway opening reduces head loss and cuts power costs.**
- **Simplicity of design and rugged construction results in trouble-free operation over a period of years.**

Bulletin "V" mailed on request

RENSSELAER VALVE COMPANY, TROY, N. Y.

(Continued from page 33)

Climaxing twenty-five years progress in the field of chlorination, Wallace & Tiernan Co. Inc. celebrated the 25th anniversary of its incorporation—November 13, 1913—with a series of Silver Jubilee celebrations.

Selecting Friday, November 11, as the nearest working day to the actual anniversary date, open house for all employees and their husbands and wives was held at the headquarters and factory at Belleville, New Jersey with an extensive program by various intercompany employee activities.

Beginning the formal part of the ceremonies at 11 o'clock, two minutes of silence, commemorating Armistice Day, was followed by sounding of Taps and a group of appropriate choral numbers by the W & T Glee Club, after which Mr. M. F. Tiernan, President of the Company, reviewed various high lights in the growth of the organization from the date of its incorporation when he and Mr. Wallace joined together in a business enterprise, without capital and without definite plans of procedure,—and traced the growth of the organization through its twenty-five years of existence to today with its thousand or more employees,—with its extensive headquarters office and factory buildings occupying over six acres at

(Continued on page 40)

A. W. W. A.
Membership Certificate

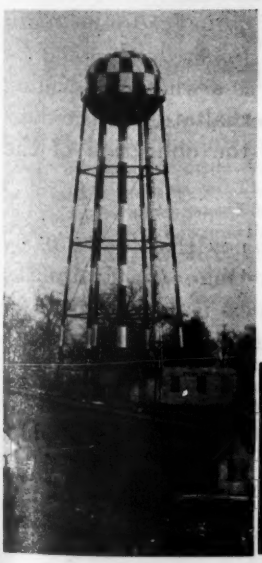
A fine newly designed parchment paper membership certificate for A. W. W. A. members is now available in 9 by 12 inch size, suitable for framing.

Give us your name—exactly as you wish it to appear. Send 40¢ in coins or postage to cover cost of lettering and mailing.

The certificate will reach you within 10 days of receipt of order —ready for you to frame and hang in your office.

P·DM 500,000 gallon Double Ellipsoidal Tank, City of Hays, Kansas. High water line 119' above foundation tops.

P·DM Steel Reservoirs, City of Atlantic, Iowa, Capacity 100,000 gallons each; 30' in diameter, 21' high.



P·DM 150,000 gallon Double Ellipsoidal Tank, North Kansas City, Missouri. High water line 142' above foundation tops.

ELEVATED or GROUND STORAGE P.DM TANKS

are designed and built to meet your specific requirements

Elevated or ground storage of water, depending upon the nature of the location, is a necessary feature of any modern economically-operated water system. P·DM's engineers can readily determine the type and quantity of water storage your community requires—and assist in the solution of every other question relating to improvement of your service.

P·DM Elevated Steel Tanks provide uniform pressures . . . ample supply at peak demand . . . supply during interruptions in pumping . . . lower pumping costs . . . low plant investment . . . low cost, dependable fire protection . . . good service for outlying districts.

P·DM Steel Reservoirs, located at sufficient elevation, provide the foregoing advantages plus the following superiorities over reservoirs built of other materials: Permanently water-tight; good for a lifetime . . . lower at first cost than any other type of construction . . . frostproof; cannot crack from ground action . . always new-looking . . occasional coat of paint . . guaranteed in design, workmanship and materials.

We invite you to use P·DM'S free engineering consultation service in any way you desire. There is no obligation of any kind—we're glad to help you!

P·DM ON THE JOB

Send for P·DM's completely illustrated descriptive Bulletins Nos. 101—"Modern Water Storage in Elevated Steel Tanks," and 102—"Standpipes and Steel Reservoirs."

PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, PA. 3424 NEVILLE ISLAND
DES MOINES, IA. 925 TUTTLE STREET

NEW YORK . . . . . ROOM 921-99, 270 BROADWAY
CHICAGO . . . 1228 FIRST NATIONAL BANK BUILDING
DALLAS . . . . . 1229 PRAETORIAN BUILDING
SAN FRANCISCO . . . . . 631 RIALTO BUILDING

(*Continued from page 38*)

Belleville, N. J. and with additional factories in Canada and England and with forty-two sales and service headquarters, together with representatives in over fifty-seven foreign countries. Mr. William J. Orchard, General Sales Manager, emphasized in his talk, "The 25th Birthday of W & T—What it Means to Me,—What it Means to You," the growth of the personnel of the organization and the fact that today more than six thousand people owe their economic existence to the activities of the organization and the fact that every product or process marketed by the Company is a direct benefit to the welfare of mankind touching on the preservation of health or life itself.

On Tuesday evening, November 15, Mr. Wallace and Mr. Tiernan tendered a banquet in the large dining room of the Company plant, to some two hundred and fifty business acquaintances, friends of the past twenty-five years, officials of the Town of Belleville and leading industrialists.

Mr. Tiernan touched upon the activities of the organization in the manufacture of chlorine control apparatus, the development of processes for maturing and bleaching flour, treatment of various industrial process waters, the chlorination of condenser water, production of lighted aids to navigation for the U. S. Lighthouse Service, development of nautical radio beacon control apparatus, development of a process for the prevention of decay in fruit and vegetables and acquisition by Novadel-Agene Corporation (an affiliate) of the Kooler-keG Beer Dispensing System.

Mr. Tiernan then introduced Colonel Willard Chevalier, publisher of "Business Week" and Vice-President of McGraw Hill Publishing Company, who spoke very forcibly on the subject, "Business Opportunities 25 Years Ago—and Today," sounding a high note of optimism to the youth of America thcugh pointing out that the door to opportunity could be open to the youth of today only when the country as a whole was willing to turn its attention much more specifically to the exhaltation of the duty of the individual to the community rather than the obligation of the community to the individual.

Housewives should save $20,000 a year in soap now that the $170,000 water softening plant is in operation at Warren, Ohio. C. E. Inman, superintendent of water works, says that the hardness is reduced from 10 or 12 grains to 5. A clarifier and mixing chamber, 55 feet in diameter, was added to the existing 60-foot clarifier. A new chemical house and substation were also added. The plant is now handling 3,000,000 gallons but Superintendent Inman expects this figure to rise to 3,500,000 when industrial conditions improve.

IT EVEN *Looks* THE PART

The Mueller-Columbian Hydrant even *looks* the part it plays in serving dependable protection to the communities it serves. The very exterior appearance makes a deep impression on those who know the arduous conditions with which a hydrant has to cope and the construction details guard against the effect of time, indifferent maintenance, freezing or accidental breakage. The extra large diameter of the hydrant barrel adds to its attractive appearance and yet retains a characteristic sturdiness. The barrel, bonnet and nozzle caps are excellently balanced in grilled design in order to add to the attractiveness of the hydrant as well as give additional strength to these points.

The interior construction backs up the exterior appearance. First--the self-oiling top assures constant lubrication. Second--the safety-flange and coupling confines damage by traffic accidents to two inexpensive parts. Third--large double bronze bushed drain valves assure complete drainage and freedom from freezing. You can be sure that the Mueller-Columbian Hydrant will not only *act* the part--it even *looks* the part.

MUELLER CO., CHATTANOOGA, TENN.

A Branch Connection While the Water Flows

QUICKLY, easily, safely, a 30" branch connection can be cut into a 30" or larger main by the use of a Smith Tapping Machine while the water in the main flows merrily along under its usual full head of pressure.

Shut-downs are avoided. They are unnecessary. Expense is saved. Danger is avoided. Health is protected.

This machine is power-operated. It uses an air-motor which supplies a smooth, steady flow of power which enables it to cut through the hardest main in less than an hour.

Other sizes of Smith Tapping Machines will make branch connections from 2" to 42" into any size mains not smaller in diameter than the connection desired.

Smith Tapping Machines are standard equipment today in the water and gas fields.

Send for full details

SMITH
TAPPING MACHINES

The A. P. Smith Manufacturing Company
East Orange, New Jersey

Smith Tapping Machines—Tapping Sleeves and Valves—O'Brien Hydrants—Valve-Inserting Machines—Removable Plugs, Pipe Cutting Machines—Corporation Tapping Machines—Gas Tee-Inserting Machines—Corporation Cocks—Federal Water Meters.

THE A. P. SMITH MFG. CO. EAST ORANGE, N. J.

ALPHABETICAL LIST OF ADVERTISERS

	PAGE
Activated Alum Corp.	13
Alco Products Div. of American Locomotive Co.	9
Alvord, Burdick & Howson	24
American Cast Iron Pipe Co.	6
American Rolling Mill Co.	10
American Water Softener Co.	—
Atlas Mineral Products Co.	4
Black & Veatch	24
Buffalo Meter Co.	12
Builders Iron Foundry	27
Burns & McDonnell Engineering Co.	24
Caird, James M.	24
Cast Iron Pipe Research Assn.	3
Central Foundry Co.	—
Chester Engineers, The	24
Chicago Bridge & Iron Co.	—
Cliffs Dow Chemical Co.	11
Cook, A. D., Inc.	36
Crane Co.	7
Dawes Silica Mining Co.	8
DeLaval Steam Turbine Co.	17
Difco Laboratories	—
Dresser, S. R., Mfg. Co.	Cover 3
Edson Corp., The	8
Everson Mfg. Co.	15
Farnan Brass Works	16
Ford Meter Box Co.	20
Fuller & Everett	24
Fuller & McClintock	24
General Chemical Co.	—
Giant Mfg. Co.	36
Gibbons, Mortimer M.	24
Graver Tank & Mfg. Co., Inc.	—
Greeley & Hansen	24
Grinnell Co.	—
Hellige, Inc.	—
Hersey Mfg. Co.	21
Hill, Nicholas S., Associates	24
Hydraulic Development Corp.	23
Industrial Chemical Sales Division, West Virginia Pulp & Paper Co.	29
International Filter Co.	—
Johns-Manville Corp	19
Johnson, Edward E., Inc.	36
Kennedy Valve Mfg. Co.	18
Kitson Company	—
Knowles, Morris, Inc	25
Kupferle, John C., Foundry Co.	20
Leadite Co.	Cover 4
Lock Joint Pipe Co.	i
Ludlow Valve Mfg. Co.	26
Mabbs Hydraulic Packing Co.	36
Mathieson Alkali Works, Inc.	—
Metcalf & Eddy	25
Mueller Company	41
National Meter Co.	33
National Water Main Cleaning Co.	28
Neptune Meter Co.	34
Newsom, Reeves	25
Pease Laboratories	25
Pennsylvania Salt Mfg. Co.	—
Permutit Company	5
Pirnie, Malcolm	25
Pitometer Co.	25
Pittsburgh-Des Moines Steel Co.	39
Pittsburgh Equitable Meter Co.	50
Pomona Pump Co.	36
Potter, Alexander	25
Potts, Clyde	25
Proportioneers, Inc.	26
Reilly Tar & Chemical Co.	32
Rensselaer Valve Co.	37
Ross Valve Mfg. Co.	14
Rusta Restor Corp.	6
Salomon, L. A., & Bro.	—
Scofield Engineering Co.	25
Smith, A. P., Mfg. Co.	42
Solvay Sales Corp.	27
Sterling Engine Co.	30
U. S. Pipe & Foundry Co.	iii
Wallace & Tiernan Co.	viii
Warren Foundry & Pipe Co.	22
Weston & Sampson	25
Whitman, Requardt & Smith	25
Wood, R. D., Co.	Cover 2
Worthington-Gamon Meter Co.	31
Worthington Pump & Mch. Co.	—

CLASSIFIED INDEX TO ADVERTISEMENTS

Access Shafting:
Alco Products Div. of American Locomotive Co.

Activated Alum:
Activated Alum Corp.

Activated Carbon:
Cliffs Dow Chemical Co.
Industrial Chemical Sales Div.
International Filter Co.

Agitators:
Alco Products, Div.
Chicago Bridge & Iron Company
International Filter Co.

Air Compressors:
DeLaval Steam Turbine Co.
Worthington Pump & Machinery Corp.

Air Lift Pumping Systems:
Worthington Pump & Machinery Corp.

Airlocks:
Alco Products Div.

Alum:
Activated Alum Corp.
General Chemical Co.
Pennsylvania Salt Mfg. Co.

Ammonia, Anhydrous:
Mathieson Alkali Works (Inc.)
Pennsylvania Salt Mfg. Co.

Ammonia Receivers:
Alco Products Div.
Chicago Bridge & Iron Company
Worthington Pump and Machinery Corporation

Ammoniators
Everson Mfg. Co.

Aqua Tester:
Hellige, Inc.

Asbestos-Cement Pipe:
Johns-Manville Corp.

Base-Exchange Silicate (Zeolite):
International Filter Co.
Permutit Co.

Boiler Blowoff Apparatus:
Farnan Brass Works Co.
Permutit Co.

Brass Goods:
(See also Pipe, Brass)
Crane Co.
Kennedy Valve Mfg. Co.
Kitson Co.
Mueller Co.
A. P. Smith Mfg. Co.

Brass Well Screens:
A. D. Cook, Inc.
Edward E. Johnson, Inc.

Calking Tools:
Mueller Co.

Calcium Hypochlorite:
Mathieson Alkali Works (Inc.)
Pennsylvania Salt Mfg. Co.

Cast Iron Pipe:
(See Pipe)

Cement Lined Pipe:
(See Pipe)

Chemical Feed Apparatus:
American Water Softener Co.
Builders Iron Foundry
Everson Mfg. Co.
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Permutit Co.
Proportioneers, Inc.
Ross Valve Mfg. Co.
Wallace & Tiernan Co., Inc.

Chemicals for Laboratory Use:
Difco Laboratories

Chemicals for Water Purification:
Activated Alum Corp.
General Chemical Co.
Industrial Chemical Sales Div.
Mathieson Alkali Works (Inc.)
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.

Chemists and Engineers:
(See Directory of Experts, page 24

Chlorinators:
Everson Mfg. Co.
Proportioneers, Inc.
Wallace & Tiernan Co., Inc.

Chlorine Comparator:
Hellige, Inc.
W. A. Taylor & Co., Inc.

Chlorine, Liquid:
Mathieson Alkali Works (Inc.)
Pennsylvania Salt Mfg. Co.
Wallace & Tiernan Co., Inc.
Solvay Sales Corp.

Clamps, Bell Joint:
S. R. Dresser Mfg. Co.
Grinnell Co.

Clarifiers:
International Filter Co.
Graver Tank & Mfg. Co., Inc.
Permutit Co.

Clay Spaders:
Worthington Pump & Machinery Corp.

Cleaning Water Mains:
National Water Main Cleaning Co.
Coagulation Control:
Activated Alum Corp.
Coatings and Linings:
(See Bituminous Coatings and Linings)
Cocks, Curb and Corporation:
Crane Co.
Farnan Brass Works Co.
Kitson Co.
Mueller Co.
A. P. Smith Mfg. Co.
Colorimetric Analysis Equipment:
Hellige, Inc.
Compressors, Portable:
Worthington Pump and Machinery Corporation
Concrete Forms:
Alco Products Div.
Condensers:
United States Pipe & Foundry Co.
Worthington Pump & Machinery Corp.
Contractors Water Supply:
A. D. Cook, Inc.
Contractors Well Drilling:
A. D. Cook, Inc.
Couplings, Flexible:
DeLaval Steam Turbine Co.
S. R. Dresser Mfg. Co.
Curb Boxes:
Farnan Brass Works Co.
Mueller Co.
Dewatering Pumps:
Worthington Pump & Machinery Corp.
Diaphragms, Pump:
Edson Corp.
Diesel Engines:
Worthington Pump & Machinery Corp.
Drills, Rocks:
Worthington Pump & Machinery Corp.
Electrically Operated Gate Valves:
Crane Co.
Kennedy Valve Mfg. Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
Enamels:
(See Pipe Coatings)
Engineers and Chemists.
Cliffs Dow Chemical Co.
(See Directory of Experts, page 24)
Engines:
(See Pumps and Pumping Engines)
Feed Water Filters:
American Water Softener Co.
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Permutit Co.
Ross Valve Mfg. Co.
Feed Water Heaters:
Worthington Pump & Machinery Corp.
Feed Water Testing Outfits:
Hellige, Inc.
Feed Water Treatment:
American Water Softener Co.
Graver Tank & Mfg. Co., Inc.
Permutit Co.
Proportioneers, Inc.
Filter Rate Controllers and Gages:
(See Rate Controllers)
Filters and Water Softening Plants
American Water Softener Co.
Chicago Bridge & Iron Company
Everson Mfg. Co.
Fuller & Everett
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Permutit Co.
Filtration Plant Equipment:
American Water Softener Co.
Builders Iron Foundry
Chicago Bridge & Iron Company
Difco Laboratories
Everson Mfg. Co.
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Mueller Co.
Permutit Co.
Filtration Sand:
Dawes Silica Mining Co.
Permutit Co.
Fittings, Copper Pipe:
Crane Co.
Farnan Brass Works Co.
Kitson Co.
Mueller Co.
Fittings, Tees, Ells, etc.:
Builders Iron Foundry
Crane Co.
S. R. Dresser Mfg. Co.
Grinnell Co.
Kennedy Valve Mfg. Co.
Kitson Co.
Flexible Joints:
Central Foundry Co.
Crane Co.
S. R. Dresser Mfg. Co.
United States Pipe & Foundry Co.
R. D. Wood Co.

Flumes, Steel:
Alco Products Div.
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Furnaces:
Mueller Co.
A. P. Smith Mfg. Co.
Gages, Surface, Reservoir and Special Water Works:
American Water Softener Co.
Builders Iron Foundry
International Filter Co.
Gas Engines:
Worthington Pump & Machinery Corp.
Gasholders:
Chicago Bridge & Iron Company
Gate Valves:
(See Valves, Gate)
Gates, Shear and Sluice:
Crane Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Gears, Speed Reducing:
DeLaval Steam Turbine Co.
Worthington Pump and Machinery Corporation
Goosenecks (with or without Corporation Stops):
Farnan Brass Works Co.
Grinnell Co.
Mueller Co.
A. P. Smith Mfg. Co.
Greensand (Zeolite):
International Filter Co.
Permutit Co.
Hose, Suction and Discharge:
Edson Corp.
Hydrants, Fire:
A. D. Cook, Inc.
Kennedy Valve Mfg. Co.
John C. Kupferle Foundry Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
Ross Valve Mfg. Co.
A. P. Smith Mfg. Co.
R. D. Wood Co.
Hydrants, Sprinkling and Flushing:
Kennedy Valve Mfg. Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
A. P. Smith Co.
R. D. Wood Co.
Hydrant Protectors:
Edson Corp.
Hydrant, Pumps:
Edson Co.
Hydraulically Operated Gate Valves:
International Filter Co.
Kennedy Valve Mfg. Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
Hydrogen Ion Equipment:
Hellige, Inc.
Indicators, Combustion, CO_2, NH_3, So_2, etc.:
Permutit Co.
Inserting Machines:
A. P. Smith Mfg. Co.
Iron Removal Plants:
American Water Softener Co.
Everson Mfg. Co.
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Permutit Co.
Jointing Materials:
Atlas Mineral Products Co.
Crane Co.
Hydraulic Development Corp.
Leadite Co., Inc.
Mueller Co.
Laboratory Apparatus:
Difco Laboratories
Lime Putty Plants:
Chicago Bridge & Iron Company
Lime Slakers and Feeders:
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Liquid Chlorine:
(See Chlorine, liquid)
Machines, Drilling:
Mueller Co.
Machines, Lead Flanging:
Mueller Co.
Meters:
Buffalo Meter Co.
Builders Iron Foundry
Crane Co.
Hersey Mfg. Co.
National Meter Co.
Neptune Meter Co.
Pittsburgh Equitable Meter Co.
A. P. Smith Mfg. Co.
Thomson Meter Corp.
Worthington-Gamon Meter Co.
Meters (Venturi Type):
Builders Iron Foundry
International Filter Co.
National Meter Co.
Meter Boxes:
Crane Co.

Ford Meter Box Co.
Mueller Co.
Pittsburgh Equitable Meter Co.

Meter Couplings:
Buffalo Meter Co.
Crane Co.
S. R. Dresser Mfg. Co.
Farnan Brass Works Co.
Hersey Mfg. Co.
Mueller Co.
National Meter Co.
Pittsburgh Equitable Meter Co.
Thomson Meter Corp.
Worthington-Gamon Meter Co.

Meter Coupling Yokes:
Ford Meter Box Co.
Mueller Co.

Meter Reading and Record Books:
Buffalo Meter Co.

Meter Testers:
Buffalo Meter Co.
Ford Meter Box Co.
Hersey Mfg. Co.
Mueller Co.
National Meter Co.
Neptune Meter Co.
Pittsburgh Equitable Meter Co.

Meter Washers:
Mabbs Hydraulic Packing Co.

Oil Engines:
Worthington Pump & Machinery Corp.

Packing, Rawhide:
Mabbs Hydraulic Packing Co.

Pavement Breakers:
Worthington Pump & Machinery Corp.

Penstocks, Steel:
Alco Products Div.
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.

Pipe, Asbestos-Cement:
Crane Co.
Johns-Manville Corp.

Pipe, Brass:
Crane Co.
A. P. Smith Mfg. Co.

Pipe, Cast Iron (and Fittings):
American Cast Iron Pipe Co.
Central Foundry Co.
Crane Co
United States Pipe & Foundry Co.
Warren Foundry & Pipe Corp.
R. D. Wood Co.

Pipe, Cement Lined:
American Cast Iron Pipe Co.
Central Foundry Co.
United States Pipe & Foundry Co.
Warren Foundry & Pipe Corp.
R. D. Wood Co.

Pipe Coatings and Linings:
Reilly Tar & Chemical Co.

Pipe, Concrete:
Lock Joint Pipe Co.

Pipe, Copper:
Crane Co.
Farnan Brass Works Co.
Mueller Co.

Pipe Cutting Machines:
Crane Co.
A. P. Smith Mfg. Co.

Pipe Jointing Materials:
(See Jointing Materials)

Pipe Joints, Mechanical:
Crane Co.
S. R. Dresser Mfg. Co.

Pipe, Lead Lined (and Fittings):
Crane Co.

Pipe, Pressure, Riveted and Welded:
Alco Products Div.
Chicago Bridge & Iron Company
Crane Co.

Pipe, Steel:
Alco Products Div.
Chicago Bridge & Iron Company
Crane Co.

Plugs:
A. P. Smith Mfg. Co.

Potentiometers:
Hellige, Inc.

Pressure Regulators:
Crane Co.
Mueller Co.
Ross Valve Mfg. Co.

Provers, Water:
Pittsburgh Equitable Meter Co.

Pumps and Pumping Engines:
DeLaval Steam Turbine Co.
Ross Valve Mfg. Co.
Sterling Engine Co.
Worthington Pump & Machinery Corp.

Pumps, Attached to Steam Turbines:
A. D. Cook, Inc.
Pomona Pump Co.
Worthington Pump and Machinery Corporation

Pumps, Centrifugal:
Worthington Pump & Machinery Corp.

Pumps, Chemical Feed:
Everson Mfg. Co.
Proportioneers, Inc.

Pumps, Deep Well:
A. D. Cook, Inc.
Crane Co.
Pomona Pump Co.
Worthington Pump & Machinery Corp.

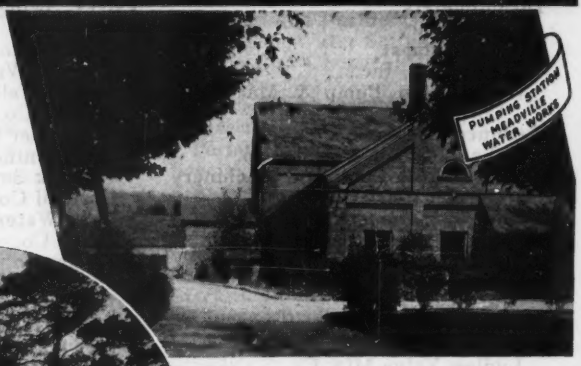
Pumps, Diaphragm:
Edson Corp.

Pumps, Hydrant:
Edson Co.

Pumps, Portable:
Worthington Pump and Machinery Corporation
Pumps, Power:
A. D. Cook, Inc.
Edson Corp.
Pomona Pump Co.
Worthington Pump & Machinery Corp.
Pumps, Proportioning:
Proportioneers, Inc.
Pumps, Sump:
A. D. Cook, Inc.
Pomona Pump Co.
Worthington Pump & Machinery Corp.
Pumps, Turbine:
A. D. Cook, Inc.
Pomona Pump Co.
Worthington Pump & Machinery Corp.
Rate Controllers:
American Water Softener Co.
Builders Iron Foundry
International Filter Co.
Recorders, Gas Density, CO_2, NH_3, SO_2, etc.:
Permutit Co.
Recording Instruments:
Builders Iron Foundry
International Filter Co.
Permutit Co.
Reservoirs, Steel:
Chicago Bridge & Iron Company
Pittsburgh-Des Moines Steel Co.
Rock Drills:
Worthington Pump & Machinery Corp.
Rust Preventive
Rusta Restor Corp.
Sand, Filtration:
Dawes Silica Mining Co.
Permutit Co.
Service Clamps, Galvanized:
Farnan Brass Works Co.
Mueller Co.
Shaft Linings:
Alco Products Div.
Sleeves:
Crane Co.
S. R. Dresser Mfg. Co.
Grinnell Co.
Mueller Co.
Sleeves and Valves, Tapping:
Crane Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
R. D. Wood Co.
Sleeves, Long, River, Split:
S. R. Dresser Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
Soda Ash:
Mathieson Alkali Works (Inc.)
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
Softeners and Purifiers:
American Water Softener Co.
Cliffs Dow Chemical Co.
Everson Mfg. Co.
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Permutit Co.
Special Vessels:
Alco Products Div.
Chicago Bridge & Iron Company
Pomona Pump Co.
Worthington Pump & Machinery Corp.
Stacks:
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Standpipes, Steel:
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Pittsburgh-Des Moines Steel Co.
Steel Plate Construction:
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Storage Tanks:
Alco Products Div.
Chicago Bridge & Iron Company
Crane Co.
Graver Tank & Mfg. Co., Inc.
Strainers, Suction:
Crane Co.
Edson Corp.
Sulphate of Alumina:
(See Activated Alum and Alum)
Sump Pumps:
A. D. Cook, Inc.
Crane Co.
Worthington Pump & Machinery Corp.
Swimming Pool Refiltration System:
Everson Mfg. Co.
International Filter Co.
Permutit Co.
Tanks, Elevated Steel:
Chicago Bridge & Iron Company
Pittsburgh-Des Moines Steel Co.
Tanks, Mixing:
Alco Products Div.
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Tanks, Steel:
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Pittsburgh-Des Moines Steel Co.
Tapping Machines:
Mueller Co.
A. P. Smith Mfg. Co.
Tapping Sleeves:
(See Sleeves and Valves, Tapping)
Taste and Odor Removal Plants:
Industrial Chemical Sales Div.
International Filter Co.
Permutit Co.

Taste Removal:
Cliff Dow Chemical Co.
Turbidimeters:
Hellige, Inc.
Turbine Pumps:
A. D. Cook, Inc.
Worthington Pump & Machinery Corp.
Turbines, Steam:
DeLaval Steam Turbine Co.
Worthington Pump and Machinery Corporation
Turbines, Water:
DeLaval Steam Turbine Co.
Valve Boxes:
Central Foundry Co.
Crane Co.
Ford Meter Box Co.
Kennedy Valve Mfg. Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
R. D. Wood Co.
Valve Inserting Machines:
A. P. Smith Mfg. Co.
Valves, Altitude:
Ross Valve Mfg. Co., Inc.
Valves, Check, Flap, Foot, Hose, Mud and Plug:
A. D. Cook, Inc.
Crane Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
Valves, Detector Check:
Grinnell Co.
Valves, Float:
Crane Co.
Ludlow Valve Mfg. Co.
Ross Valve Mfg. Co., Inc.
Valves, Gate:
Crane Co.
S. R. Dresser Mfg. Co.
Kennedy Valve Mfg. Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
United States Pipe & Foundry Co.
R. D. Wood Co.
Valves, Large Diameter:
Alco Products Div.
Crane Co.
Ludlow Valve Mfg. Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
Valves, Regulating:
Crane Co.
Mueller Co.
Ross Valve Mfg. Co.
Valves, Relief (Temperature and Pressure):
Crane Co.
Kitson Co.
Mueller Co.
Valves, Swing Check:
Crane Co.
Grinnell Co.
Kennedy Valve Mfg. Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
Valves, Uniflow Check (for Double Check Service):
Grinnell Co.
Valves, Water Meter Protection:
Crane Co.
Kitson Co.
Water Softener (Hot Lime Soda):
International Filter Co.
Permutit Co.
Water Softener (Zeolite):
International Filter Co.
Permutit Co.
Water Softening Plants:
American Water Softener Co.
Everson Mfg. Co.
Fuller & Everett
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Permutit Co.
Water Supply Contractors:
A. D. Cook, Inc.
Water Testing Apparatus:
Hellige, Inc.
W. A. Taylor & Co., Inc.
Water Treatment Plants:
American Water Softener Co.
Everson Mfg. Co.
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Permutit Co.
Water Waste Detection:
Builders Iron Foundry
Pitometer Co.
Water Leak Detector Co.
Water Works Construction, General:
Pittsburgh-Des Moines Steel Co.
Well Drilling Contractors:
A. D. Cook, Inc.
Well Screens:
A. D. Cook, Inc.
Crane Co.
Edward E. Johnson, Inc.
Wrenches, Ratchet:
Crane Co.
S. R. Dresser Mfg. Co.
Zeolite (Water Softener):
Graver Tank & Mfg. Co., Inc.
International Filter Co.
Permutit Co.
Zeolites (Natural and Synthetic Minerals):
International Filter Co.
Permutit Co.

In MEADVILLE, Pa.



Located in the extreme Northwestern corner of Pennsylvania, Meadville is a city having a population of 19,354, and is the center of a rich agricultural district. Here is the home of Allegheny College, a College of Liberal Arts of high standing, founded in 1815. This city has an interesting historical background; its Sesqui-Centennial was celebrated in May of this year.

Meadville is also an important industrial center, which includes the plant of the American Viscose Corporation, world's largest manufacturer of rayon, and the three plants of Talon, Incorporated, world's largest manufacturer of the widely used slide fastener.

The first public water system was built in 1874 by a private company and was purchased by the City of Meadville in 1899. The water supply is from wells located one mile from the city and is unusual in quality as no treatment of any kind is required. The wells are in glacial gravel, two of them producing over 2000 G. P. M. each.

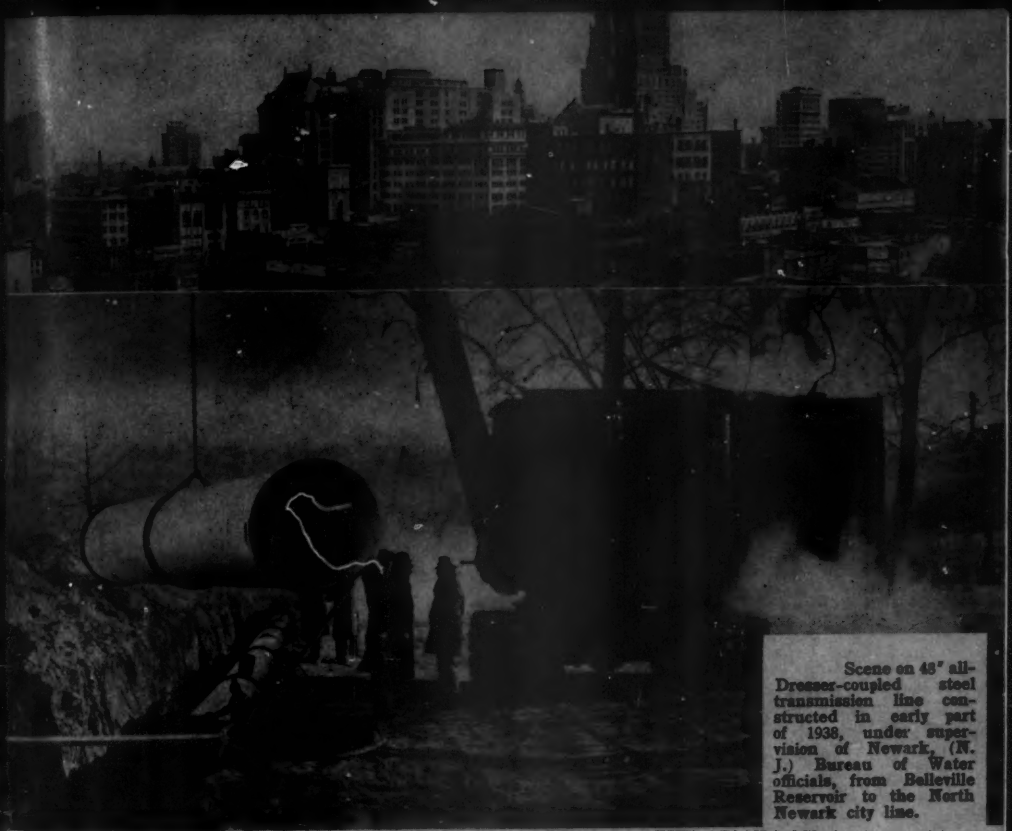
The system is 100% metered, Pittsburgh Water Meters being used, some of which have been in service for forty years. The Water Department operates entirely on its own revenues and is free from debt.

PITTSBURGH EQUITABLE METER COMPANY

MERCO NORDSTROM VALVE CO.

NEW YORK · BUFFALO · PHILADELPHIA · KANSAS CITY · TULSA · LOS ANGELES — *Main Offices* - PITTSBURGH, PA. — DES MOINES · CHICAGO · COLUMBIA · MEMPHIS · OAKLAND · HOUSTON

PITTSBURGH WATER METERS



Scene on 48" all-Dresser-coupled steel transmission line constructed in early part of 1938, under supervision of Newark, (N. J.) Bureau of Water officials, from Belleville Reservoir to the North Newark city line.

In NEWARK as elsewhere!

A METROPOLITAN TREND!

Many large and important cities are Dresser-coupling users. To mention a few:

Buffalo, N.Y. — Philadelphia, Pa.
Cleveland, Ohio — San Francisco, Cal.
Detroit, Mich. — St. Louis, Mo.

w Newark, busy New Jersey metropolis, installs an all-Dresser-coupled er line! Size: 48"; test pressure: 200 lbs. per sq. in. with all couplings tle-tight; reasons for Dresser-coupling this line: tightness, flexibility, simcity, speed, and TRUE economy! Line was backfilled promptly as laying gressed.

FIVE REASONS WHY MODERN WATER LINES ARE DRESSER-COUPLED:

1. PERMANENT TIGHTNESS—proved for 50 years, on 150,000 miles of pipe.
2. FLEXIBILITY—normal pipe movements—present in every line—are absorbed.
3. SIMPLICITY—joints are "factory-made"; ordinary labor can install.
4. STRENGTH—predetermined; joints safely withstand any specified pressure.
5. TRUE ECONOMY—a truly lower joint cost throughout the life of the line.

Write for our General Catalog No. 36.

Cutaway view of Dresser Coupling, Style 38, showing working principle. Note that plain-end pipe is used. The resilient rubber-compound gaskets, flexing with the pipe, safely absorb pipe movements, thus preventing failures that often occur with rigid joints.

HE MODERN TREND IS TO DRESSER COUPLINGS

DRESSER MFG. COMPANY, BRADFORD, PA. • 230 Park Avenue, New York, N.Y. • Peoples Gas Building, Chicago, Ill. • Shell Building, Houston, Tex.
1013 Post Street, San Francisco, Calif. • *In Canada:* Dresser Mfg. Company, Ltd., 68 Front Street, West, Toronto, Ontario

LEADITE

Jointed for . . . Permanence with LEADITE

Generally speaking, most Water Mains are buried beneath the Earth's surface, to be forgotten,—they are to a large extent, laid for permanency. Not only must the pipe itself be dependable and long lived,—but the joints also must be tight, flexible, and long lived,—else leaky joints are apt to cause the great expense of digging up well-paved streets, beautiful parks and estates, etc.

Thus the "jointing material" used for bell and spigot Water Mains MUST BE GOOD,—MUST BE DEPENDABLE.—and that is just why so many Engineers, Water Works Men and Contractors aim to PLAY ABSOLUTELY SAFE, by specifying and using LEADITE.

Time has proven that LEADITE not only makes a tight, durable joint,—but that it improves with age.

The pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%

THE LEADITE COMPANY
Girard Trust Co. Bldg. Philadelphia, Pa.

No Caulking

End